



North Fork Lost Man Creek Bridge Environmental Assessment

Redwood National Park
Humboldt County, California
July 2009

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ENVIRONMENTAL ASSESSMENT

North Fork Lost Man Creek Bridge Redwood National Park Humboldt County, California

Introduction

Redwood National Park was established by Congress in 1968 to "preserve significant examples of the coastal redwood ... forests and the streams ... with which they are associated for purposes of public inspiration, enjoyment, and scientific study." [Public Law 90-245, Section 3(e)].

In 1978, Congress expanded the national park by acquiring privately owned timber lands, most of which had been logged. The legislation expanding the park authorized the National Park Service (NPS) to develop a program for the rehabilitation of those lands "to reduce risk of damage to streamside areas and for other purposes" (Public Law 95-250, Section 101(a) (6)). Since 1978, the NPS has been conducting watershed restoration activities in accordance with the legislation.

The 1999 Redwood National and State Parks *Final General Management Plan/General Plan, Final Environmental Impact Statement/Environmental Impact Report* (RNSP GMP/FEIS) described a program to remove or upgrade abandoned logging roads to reduce the potential for erosion at stream crossings and from unstable road segments. The proposed action would be implemented as part of the national park watershed restoration program described in the GMP. This environmental assessment (EA) is tiered off the GMP/EIS.

This project, if approved, would be accomplished under a grant from the California Department of Fish and Game (CDFG) Fisheries Restoration Grant Program (FRGP) for restoration of salmonid habitat in California streams.

Background

Lost Man Creek is a tributary of Prairie Creek, which is the largest tributary of Redwood Creek (Figure 1). Lost Man Creek and Prairie Creek contain some of the best remaining spawning habitat for salmonids in RNSP. Intensive logging and the dense network of logging roads severely damaged aquatic habitat throughout Redwood Creek watershed.

The North Fork Lost Man Creek project site is located on Geneva Road, a former logging road (Figure 2). The road was constructed by the Geneva Lumber Company and the California Barrel Company between 1946 and 1954 to move logs from harvest areas in the Lost Man Creek watershed to the mills. Logging in the Lost Man Creek watershed and use of Geneva Road to haul logs ceased upon creation of Redwood National Park in 1968.

Geneva Road crosses North Fork Lost Man Creek about 600 feet upstream of the confluence of the north fork and the mainstem of Lost Man Creek. Stream crossings require a drainage structure to allow stream flow to pass under the road. Drainage structures are typically either a culvert with road fill surrounding the culvert, or a bridge. Road fill is placed on top of the drainage structure to create a roadbed. Drainage structures must be large enough to convey streamflow under the road even during large storms or else the road will be damaged by the excess water.



Figure 1. Regional map of northwestern California showing Redwood National and State Parks and the project area location.

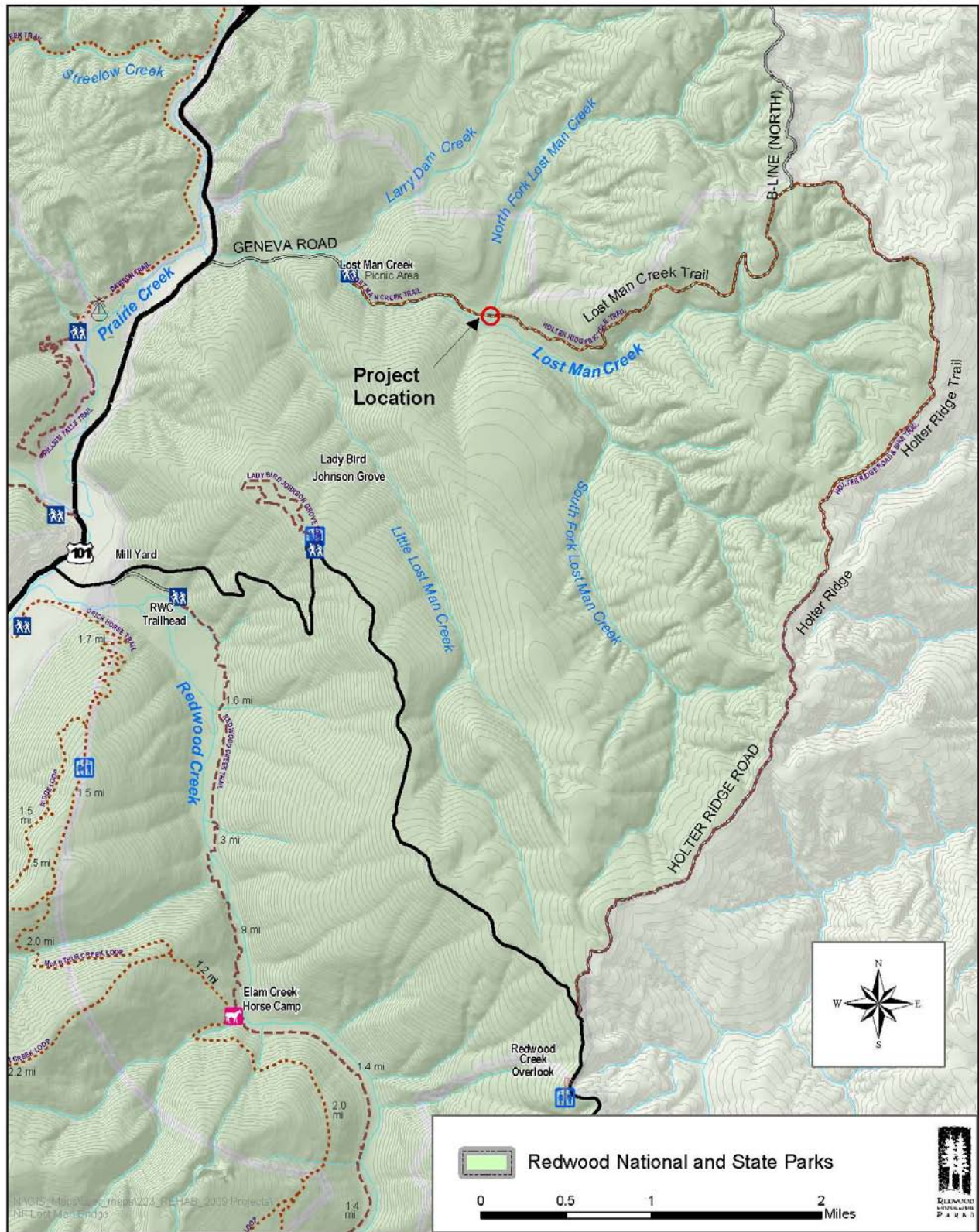


Figure 2. Location of North Fork Lost Man Creek Bridge Project.

When streamflow exceeds the capacity of a drainage structure, the excess water can saturate the road and erode the fill, which causes slumps and holes in the roadbed. At higher flows, the stream can overtop the road fill and erode it, causing the road fill to fail. When a stream crossing fails, the road fill in the crossing and the sediment accumulated upstream of the crossing erodes, or the stream diverts out of its original channel and flows down the road or hillslopes, creating gullies or initiating landslides. Sediment eroded from failed roads and stream crossings eventually ends up in the stream.

Lost Man Creek and its tributaries are occupied by three species of anadromous salmonid fishes that are listed as threatened under the federal Endangered Species Act; one of these species is listed by the State of California. Anadromous fish spend most of their adult lives in the ocean and migrate from the ocean to spawn in the same freshwater streams in which they spent the first part of their lives. These fish require spawning gravels that are free of fine sediment to allow the eggs and early life stages to obtain sufficient oxygen to survive. North Fork Lost Man Creek is designated critical habitat for these fish.

The old logging roads in what is now the park were constructed and maintained at a lower standard than the current California Forest Practice Rules require for logging operations. Current rules require that drainage structures have sufficient capacity to accommodate a 100-year flow event to reduce the likelihood of stream crossing failure and subsequent damage to aquatic resources.

Culverts that are too small, plugged by debris, collapsed, or placed higher than the level of the streambed act as barriers to fish passage and reduce the numbers of fish that are able reach upstream spawning grounds. As old culverts are replaced due to failure or as part of road upgrades, the National Oceanic and Atmospheric Administration (NOAA) Fisheries aka National Marine Fisheries Service (NMFS) requires that NPS install drainage structures capable of accommodating a 100-year flow event. Adequately sized and properly installed drainage structures increase the spawning success rate of anadromous fish by facilitating access to stream reaches with suitable spawning habitat.

Geneva Road is maintained for park administrative access to previously logged areas that are being restored through the watershed restoration program. The Lost Man Creek Trail was established on Geneva Road as a hiking and bicycle trail.

Purpose and Need for Action

The North Fork Lost Man Creek project site consists of one stream crossing that contains two adjacent parallel culverts (Figure 3). The combined volumes of the culverts are too small to accommodate a 100-year flow event. A 100-year discharge is estimated to be about 750 cubic feet per second (cfs); a two-year discharge is estimated to be about 200 cfs. The existing culverts can safely accommodate about 115 cfs. At flows greater than 115 cfs, water backs up behind the road fill and begins to saturate the fill, increasing the likelihood of failure. Failure of the stream crossing would cause sediment to be delivered into Lost Man Creek and eventually into Prairie Creek, damaging fish habitat. The Lost Man Creek Trail would be unusable by either administrative vehicles or hikers and bicyclists if the stream crossing fails.

In addition to being undersized, the two culverts have partially crushed inlets and the outlets are approximately two feet above the natural channel grade, which creates a barrier to upstream fish passage (Figures 4 and 5).

The purpose of this project is to remove two damaged, undersized culverts at the stream crossing on North Fork Lost Man Creek and to replace the culverts with a bridge. This project is needed to improve access to spawning habitat for threatened fish species and to prevent additional damage to fish habitat from sediment associated with failure of these drainage structures. The bridge is needed to ensure the

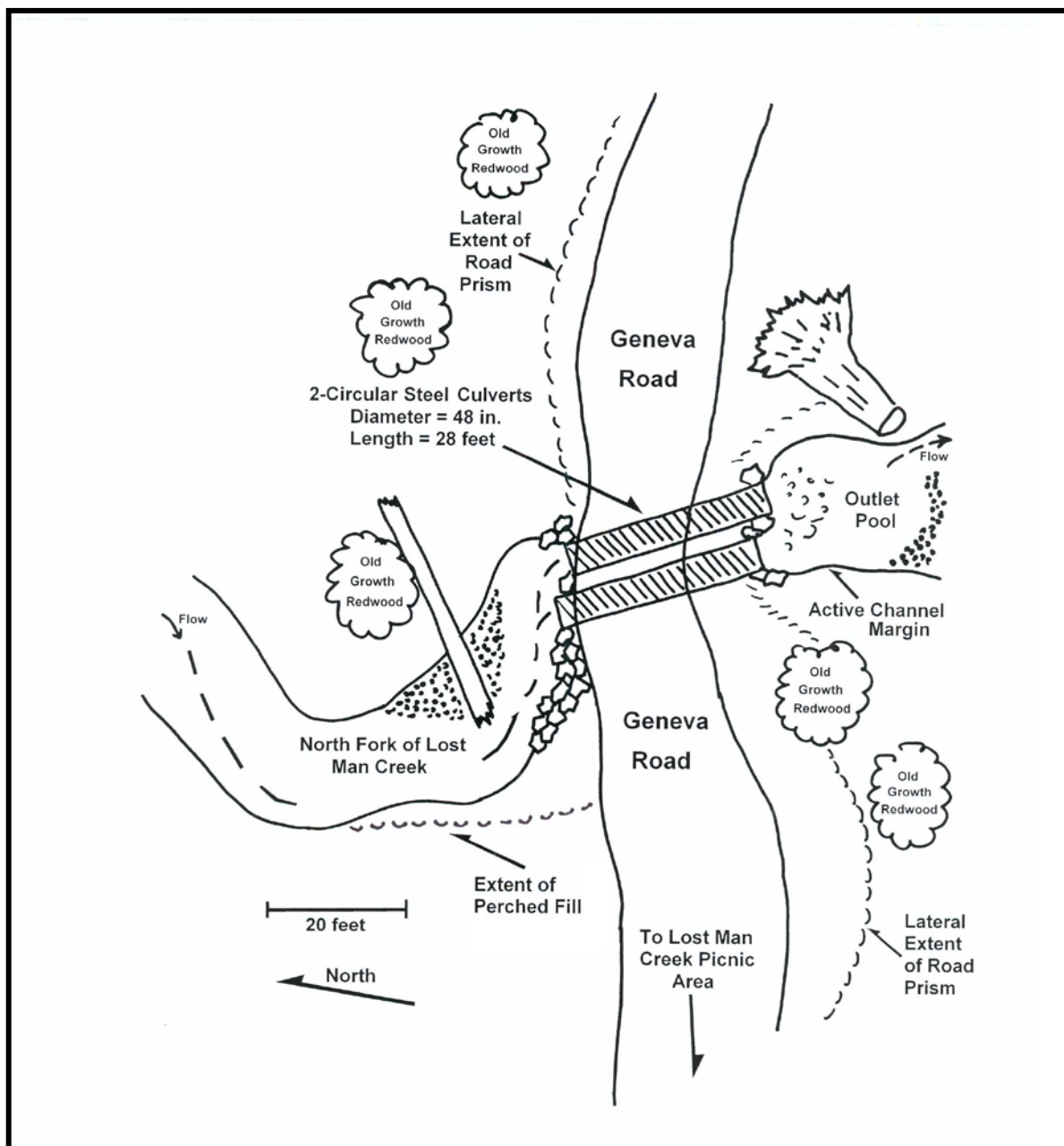


Figure 3. Sketch map of the project site on North Fork Lost Man Creek from site conditions on May 22, 2007.



Figure 4. Culvert inlets of North Fork Lost Man Creek stream crossing. Photo date: May 1, 2007.



Figure 5. Culvert outlets of North Fork Lost Man Creek stream crossing. Photo date: May 1, 2007.

Lost Man Creek Trail continues to provide a safe and enjoyable experience for hikers and bicyclists and the road provides administrative access needed for watershed restoration and other resource management projects in Redwood National Park.

Alternatives, Including the Proposed Action

Two alternatives are analyzed in this environmental assessment, the proposed action and a no action alternative. Under the proposed action, the two culverts would be removed and replaced with a bridge. Under a no action alternative, the culverts would not be replaced until they fail and the road becomes impassable. An alternative in which the culverts would be removed but not replaced is not an option because the road is needed for administrative access for future watershed restoration projects.

The no action alternative is required under NPS guidelines for compliance with the National Environmental Policy Act (NEPA) and is used to compare existing conditions with the proposed action. No action means either a continuation of existing management practices or “no project.” In this case, the no action alternative is the current management action, which includes maintenance of the existing culverts and road surface but no removal or replacement of the two culverts.

Alternative 1: No Action—Under this alternative, the NPS would perform maintenance of the existing culverts by periodically removing debris that accumulates at the culvert inlets and grading the road to maintain proper road surface drainage and safe access for administrative vehicles, hikers, and bicyclists.

Alternative 2: Remove Culverts and Replace with a Bridge (Proposed Action, Environmentally Preferred Alternative)—Under this alternative, the NPS would remove two side-by-side 48-inch-diameter corrugated metal pipe culverts through which the North Fork Lost Man Creek flows. About 2,100 cubic yards of road fill would be excavated from the stream crossing and along about 70 feet of the channel immediately upstream of the crossing. Sediment accumulated in the channel, immediately upstream of the existing culverts, also would be excavated from the channel to restore channel grade and form. About 60 feet of road would be treated as part of the crossing treatment. The stream crossing and the upstream streambank would be reshaped to resemble the original topography as closely as possible.

A bridge would be installed across North Fork Lost Man Creek in the same location as the current roadway. The bridge would be 60 feet long with a minimum rating to accommodate a live load of 80,000 pounds, and 14 to 16 feet in width, with handrails on each side; final bridge specifications would be determined through a competitive bid contract process. Concrete bridge abutments approximately 8 feet by 16 feet would be poured in place on each side of North Fork Lost Man Creek outside of the channel. Heavy equipment and block and tackle would be used to place the bridge on the abutments.

The road surface on either side of the bridge would be surfaced with gravel and graded. The bare soils would be covered with vegetation salvaged during excavation or with locally obtained mulch to reduce surface erosion following treatment.

If there is sufficient flow to warrant diversion, the stream would be diverted around excavation site to prevent introduction of sediment into the channel. If fish are present in the reaches of stream that would be affected by dewatering, NOAA Fisheries protocols for fish relocation and dewatering would be followed (Appendix A, USDC 2001).

All excavated material would be moved to a stable location approximately 750 feet west of the crossing where the material would not erode into the stream. The material would be shaped to blend with the surrounding topography and covered with vegetation removed during excavation or other locally obtained mulch to reduce post-excavation erosion. Native vegetation salvaged from the excavation site would be replanted after the bridge is installed and the road is graveled.

Large earthmoving equipment including an excavator, bulldozer, backhoe, loader, dump truck and roller would be used for earthmoving and to reconstruct the road crossing and surface. Work that requires heavy equipment and other tools that create noise in excess of ambient noise would be done after September 15th to reduce adverse effects on noise-sensitive threatened bird species. The CDFG grant requires that all instream work occur between June 15th and October 31st. Instream channel excavation would occur after September 15th and would be completed prior to the onset of the rainy season to avoid erosion and runoff of disturbed soils. If work involves soil excavation adjacent to the active stream channel after October 15th, work sites would be “winterized” at the end of each work day to reduce the chance of erosion and runoff in the event of an unexpected rain storm. Winterizing, seasonal timing and other best management practices (Appendix B) would be implemented to reduce short-term adverse effects on listed salmonids from erosion. A complete list of required mitigation measures to minimize adverse effects on listed fish species from projects funded under the CDFG Fisheries Restoration Grant Program is found in the CDFG California Salmonid Stream Habitat Restoration Manual, Third Edition, Volume II (CDFG 2002) with three new chapters added in 2003 and 2004 (Chapter IX: Fish Passage Evaluation at Stream Crossings; Chapter X: Upslope Assessment and Restoration Practices; and Chapter XI: Riparian Habitat Restoration). Chapters IX and XI apply specifically to the proposed action. Mitigation measures and techniques in Chapter X are also routinely incorporated in watershed restoration activities such as the proposed action.

The Lost Man Creek Trail would be closed to public use during heavy equipment operations and bridge construction. Information and trail closures related to the project would be posted at the trailheads and visitor centers and announced through news releases and visitor contacts. The project is expected to require trail closure for about four weeks. Wet soil conditions might require longer closures for safety and resource protection. If approved, the project must be completed by mid-March 2010 under the terms of the CDFG FRGP.

Environmentally Preferred Alternative

The environmentally preferred alternative is the one that best meets the criteria identified in Section 101 of the National Environmental Policy Act (NEPA) as outlined below.

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.
- Preserve important historic, cultural and natural aspects of our national heritage.
- Enhance the quality of renewable resources.

The NPS has determined that *Alternative 2: Remove Culverts and Replace with a Bridge* (the Proposed Action) is the environmentally preferred alternative. This alternative would improve habitat and reduce adverse effects on three species of anadromous salmonids listed as threatened by:

- improving fish passage to upstream spawning areas by removing a stream crossing culverts that partially block the stream channel;
- restoring the original topography of the stream channel and banks by removing excess sediment;
- improving water quality by reducing input of fine sediment; and
- reducing the threat of sediment delivery to the stream from unstable road fill.

The proposed action would also improve visitor safety by installing a bridge with handrails.

The no action alternative is not the environmentally preferred alternative because it would not reduce the potential for eventual failure of the stream crossing. The culverts would continue to degrade and the

stream crossing would gradually erode or eventually fail massively in a storm. The sediment delivered to the stream would move downstream and further degrade the quality of spawning habitat for threatened salmonids. The culverts would continue to limit fish passage to habitat upstream of the crossing.

Consultation with Other Agencies

Clean Water Act Consultations—Removing the stream crossing, associated road segment and aggraded material in the stream channel, and installing a bridge at the North Fork Lost Man Creek stream crossing would be conducted under the U.S. Army Corps of Engineers (Corps) San Francisco District's Regional General Permit No. 12 (RGP 12, Corps File No.: 27922N) in compliance with Section 404 of the Clean Water Act. The RGP was issued September 9, 2004 and expires December 1, 2009; it is being renewed for an additional five years. RGP 12 covers all projects funded by the CDFG Fisheries Restoration Grant Program for the purpose of restoring salmonid fisheries habitat in non-tidal reaches of rivers and streams, improving watershed conditions impacting salmonid streams and improving the survival, growth, migration and reproduction of native salmonids. Specific activities listed in the RGP that would occur under the proposed action include improving fish passage at stream crossings by replacing barrier culverts with bridges, and watershed and stream bank stability activities to reduce sediment from watershed and stream bank erosion.

Endangered Species Act Consultations—Three federally-listed threatened salmonids occupy the project area—Southern Oregon/Northern California Coast coho salmon (*Oncorhynchus kisutch*), California Coastal Chinook salmon (*O. tshawytscha*) and Northern California steelhead (*O. mykiss*). Effects on listed salmonids and their designated critical habitat from activities authorized under RGP 12 have been analyzed in NOAA Fisheries' RGP 12 Biological Opinion, dated May 21, 2004 (Ref. Doc. No. 151422SWR03AR8912:FRR/JTJ) in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA; 16U.S.C.1521 et seq.). NOAA Fisheries' RGP 12 Biological Opinion analyzed the effects of the RGP 12 authorized activities on six populations of threatened salmonids occupying coastal streams in northern and central California. The Biological Opinion provides ESA section 7 consultation coverage for the potential effects to listed salmonids from the North Fork Lost Man Creek fish passage improvement project. NOAA Fisheries is presently preparing a Biological Opinion for the renewal of RGP 12.

NOAA Fisheries determined that the activities authorized through the RGP would not affect the California Coastal Chinook salmon. NOAA Fisheries also determined that the proposed RGP is not likely to jeopardize the continued existence of the Southern Oregon/Northern California Coast coho salmon or Northern California steelhead. NOAA Fisheries anticipates that take of listed species as a result of projects authorized under the RGP will be in the nature of temporary displacement and/or reduction in feeding rates (with a possible minimal level of mortality) and will have no long-term negative effects on the survival and recovery of listed species.

The effects on northern spotted owls and marbled murrelets from activities described in this EA have been analyzed in Mill Creek and Lost Man Creek Trails Culvert Replacement Biological Assessment sent to the U.S. Fish and Wildlife Service (USFWS) on June 6, 2005. The NPS determined that the proposed action may affect but will not adversely affect northern spotted owls due to minor amounts of habitat degradation. Nesting marbled murrelets will be adversely affected by noise disturbance occurring within a quarter mile of nine acres of suitable low to medium quality nesting habitat. Pacific fishers may be affected but the effects will be negligible within the local population due to minor amounts of habitat degradation. The USFWS Biological Opinion, dated July 14, 2005 (Ref. Doc. No. 8-14-2005-2558) concurred with the NPS determination.

Cultural Resource Consultations—The National Historic Preservation Act of 1966 requires federal agencies to consult with the state historic preservation officer (SHPO) if an undertaking would have the

potential to affect properties listed or eligible for listing on the National Register of Historic Places. The NPS notified the SHPO in February 2009 that an environmental assessment was being prepared and outlined the project. This correspondence also sought concurrence from the California SHPO that NPS had taken sufficient measures to identify resources eligible for or listed on the National Register of Historic Places within the project area of potential effect. The SHPO responded April 13, 2009 with concurrence that these steps were adequate.

NPS policies require consultation with affected American Indian groups. Consultation with the Yurok Tribe Heritage Preservation Officer was submitted by NPS for review for this project under 36 CFR 800 in February 2009 seeking concurrence that NPS had taken sufficient measures to identify resources eligible for or listed on the National Register of Historic Places within the project area of potential effect.

Ethnographic interviews were conducted in 2000 that provided information about the project area being used for resource procurement and fishing along the lower reaches of the Lost Man Creek watershed. Consultation with the Yurok Tribes Culture Committee about the entire Lost Man Creek Watershed occurred on August 26, 2005 and November 18, 2005 in the Klamath Tribal office. Notes from these meetings are on file at the Yurok Culture Department. The initial consultation with the Yurok Tribe Culture Committee resulted in the recommendation to speak in detail with a Yurok elder who has knowledge of the history of trails and logging history of the area and a traditional Yurok basket maker with resource knowledge of the area, particularly a bear grass area close to the coast used by Yurok basket makers. Consultation specific to this project with the Yurok Tribe Culture Committee were conducted on June 27, 2008 (Appendix A, Burns and Ainis 2008).

Government-to-government consultations with the Yurok Tribe are also on-going as part of the NEPA process associated with this proposed action.

Compliance with Floodplains and Wetlands Executive Orders

The NPS carries out its responsibilities to manage floodplains and wetlands in compliance with Executive Orders 11988 "Floodplain Management" and 11990 "Protection of Wetlands" under procedures described in Director's Orders #77-1 Wetland Protection and #77-2 Floodplain Management and their associated implementation manuals. A Statement of Findings (SOF) for effects to Floodplains and Wetlands will not be prepared for this project. The purpose of the proposed action is to remove structures that degrade the natural floodplain and wetland values associated with North Fork Lost Man Creek, and to restore natural floodplain and wetlands functions and values in a small area. Actions designed specifically for the purpose of restoring degraded natural wetland, stream, riparian, or other aquatic habitats or ecological processes are exempt from the NPS requirement to prepare a wetland SOF. Actions located in floodplains that involve little physical development and do not involve overnight occupation are exempt from the NPS requirement to prepare a floodplain SOF.

Public Involvement

This project on North Fork Lost Man Creek is similar to the much more extensive watershed restoration project that is almost completed in other parts of Lost Man Creek watershed. Public comment received on the watershed restoration proposal in the 1999 GMP/EIS, the 2006 Lost Man Creek restoration project, and other similar projects in and around the parks and in the region directed at restoration of salmonid habitat indicates broad public support for such projects. Therefore, no specific public scoping was conducted for this project. The impact topics addressed in this EA are the same for natural and cultural resources as those addressed in the Lost Man Creek restoration project. In addition to effects on resources, this EA addresses effects on visitors and park operations from making improvements to an existing road/trail that would be damaged if the stream crossing fails. The EA will be sent to local and regional offices of federal and state agencies, to affected American Indian tribes, and to individuals and local organizations who commented on a recent trail plan for the national park. Copies will be available

in local libraries and at park offices, and on the internet on the Redwood National Park homepage. Letters announcing the availability of the EA will be sent to elected officials, organizations, and individuals who have expressed interest in similar projects.

Affected Environment

Climate and Air Quality—The project area has a mild climate due to its low elevation and proximity to the Pacific Ocean. The average temperature range reported at Prairie Creek Redwoods State Park during winter is 35-55 degrees (Fahrenheit) and 40-75 degrees in summer. Mean daytime temperatures at Prairie Creek Redwoods State Park are 47 degrees in January and 59 degrees in June. Most precipitation falls as rain between November and April. Average rainfall in the project area is about 60 inches annually. Snow is very rare. High winds occur in the Prairie Creek valley during major winter storms. Sustained wind speeds exceeding 35 mile per hours generally cause trees and branches to fall, and result in road and trail closures throughout the park.

Air quality in the project area, as in all of RNSP, is excellent due to lack of major pollutant sources from the direction of the prevailing northwest winds across the Pacific Ocean. Primary pollutant sources are vehicle emissions from roads and highways, dust created by vehicles driving on dirt roads, smoke from woodstoves during cold months, prescribed fires in the region, and wildfires. Only wildfires and prescribed fires have the potential to reduce air quality below state or federal air quality standards.

Topography, Geology, and Soils—Topography refers to the shape and relief of the surface of land, ranging from flat to rolling to mountainous. Rapid tectonic uplift; abundant, intense rainfall; and sheared bedrock make much of the park highly erodible, and generally rugged.

Elevations in the Lost Man Creek watershed range from about 60 feet above sea level at the confluence with Prairie Creek to about 2,250 feet along Holter Ridge on the eastern watershed divide with Klamath River. Slopes range from near level in the alluvial valley bottoms of lower Lost Man Creek to over 100% within the inner gorges of the upper Lost Man Creek tributaries. Overall, slopes average about 30%–40% in the watershed.

The project area lies very near the confluence of North Fork Lost Man Creek with Lost Man Creek where relatively narrow stream-side terraces flank the creeks within a relatively confined valley. An indistinct floodplain is present along the channel above the confluence of the south and middle forks of Lost Man Creek. Below this confluence, the channel is generally less confined and the floodplain is better defined. At the project site, a narrow floodplain is present along both North Fork Lost Man Creek and the mainstem of Lost Man Creek.

The North Fork Lost Man Creek watershed is underlain by two distinct geologic formations - Prairie Creek Formation and Franciscan Formation. The Prairie Creek Formation is composed of coastal plain sediments that are weakly consolidated and highly erodible due to low amounts of clay and high amounts of sand, gravel, cobbles, and silts. The sediments are thought to have been deposited in a river delta laid down by the Klamath River more than two million years ago. The Franciscan formation is comprised of Mesozoic-age (Jurassic to Cretaceous) rocks laid down on the ocean floor as deposits of sand and mud about 150 to 100 million years ago. These deposits were eventually uplifted to form the Coast Range. Through time, folding and faulting further complicated the Franciscan complex rocks. Franciscan bedrock in the project area is mostly composed of sedimentary greywacke sandstone and mudstone, with minor amounts of conglomerate.

Hydrology and Water Quality—Lost Man Creek is a tributary of Prairie Creek, the largest tributary of Redwood Creek. Lost Man Creek has a drainage area of about 7,700 acres and enters Prairie Creek about 3 miles upstream of the confluence of Prairie Creek and Redwood Creek. Lost Man Creek (exclusive of

its north fork tributary) has a length of 6.3 miles from its headwaters to its confluence with Prairie Creek. North Fork Lost Man Creek has a drainage area of about 1,480 acres and flows for 2.9 miles from the headwaters to its confluence with the mainstem of Lost Man Creek. The stream flow for a 100-year flow event on North Fork Lost Man Creek at the project area is estimated to be about 750 cfs.

Temperature and turbidity are the two primary indicators of water quality in park streams. There are essentially no other point-source or non-point source pollutants (pesticides, fertilizers, bacteria) that affect park streams, which are mostly upstream of residential and agricultural areas. Petrochemical runoff from roads and highways do not cause major pollution problems. Water quality in Prairie Creek at the confluence with Lost Man Creek is very good, especially in comparison to other park streams that have been affected by logging. As soils stabilized and vegetation re-grew (particularly overstory trees that provide shade to cool a stream) since logging ceased in 1978, water quality in Lost Man Creek is assumed to have improved.

Turbidity in Lost Man Creek has been monitored in relation to restoration work being conducted throughout the watershed, including work upstream of the North Fork Lost Man Creek project site. The main focus of the monitoring project was to document the effects of road removal on water quality, specifically turbidity and suspended sediment concentration. Winter storm sampling for turbidity and suspended sediment concentration at North Fork Lost Man Creek and several other locations in the watershed has continued for six years (Water Years 2003-08).

The monitoring study concluded that some stream crossing excavations briefly contributed large amounts of sediment to downstream channels, but contributions generally decreased rapidly over time. There is a direct correlation between treatment intensity (length of stream channel treated) and turbidity (NPS 2009a).

Floodplains and Wetlands—At the project site, a narrow floodplain is present along both North Fork Lost Man Creek and the mainstem of Lost Man Creek. Based on the size of the existing culverts to be removed, the road is assumed to be subject to inundation by storms exceeding a 25-year flow event. If the culverts plug with debris during a storm, the road would be flooded by lesser flows.

The Lost Man Creek watershed is well-drained because of its steepness, precluding the development of extensive riparian zones and wetlands. Wetlands in the project area consist of riparian zones that line Lost Man Creek. The riparian zone is most extensive at the confluence of the creeks and the downstream reaches. Red alder and skunk cabbage in the riparian zones are the primary obligate wetland plants in the project area.

Vegetation—Extensive timber harvest occurred in the upper reaches of Lost Man Creek watershed from the mid-1940s until the area was added to the national park in 1968. The lower reaches were not harvested and contain old growth redwood forest. Approximately 1,665 acres in the Lost Man Creek watershed are intact old growth forest. The project site is located within the old growth forest. Prior to harvesting, the vegetation was redwood forest, which includes coast redwood, Douglas-fir, and Sitka spruce as the dominant tree species.

Fish and Wildlife—Sensitive or threatened fish that occupy North Fork Lost Man Creek are described below under *Sensitive, Threatened and Endangered Species*. Other fish identified or reported in Lost Man Creek include resident rainbow trout (*Oncorhynchus mykiss*), prickly sculpin (*Cottus asper*), coastrange sculpin (*Cottus aleuticus*), riffle sculpin (*Cottus gulosus* Girard), threespine stickleback (*Gasterosteus aculeatus*), and Pacific lamprey (*Lampetra tridentata*).

The project area is inhabited by amphibians, reptiles, birds and mammals typically found in old growth redwood forest and riparian zones in the parks. Pacific giant salamanders (*Dicamptodon ensatus*) have been observed on roads or under logs and bark and larvae have been observed in Lost Man Creek. These salamanders probably occur throughout perennial streams in the watershed, including the North Fork Lost Man Creek project area. The project area is also inhabited by northern red-legged frogs (*Rana aurora*) and tailed frogs (*Ascaphus truei*). Larger mammals that have been seen in the vicinity of the project area include black bears, cougars, bobcats, Roosevelt elk, and black-tailed deer.

Sensitive, Threatened and Endangered Species—Botanical surveys of the project area were conducted under contracts issued by CDFG. No rare or sensitive plants were discovered in the project area.

No suitable habitat or designated critical habitat for spotted owl or marbled murrelets would be affected by the proposed action. The project would be conducted after September 15 and completed prior to February 1, so there would no noise or disturbance effects on either northern spotted owls or marbled murrelets.

Four species of anadromous salmon and trout occupy the stream in the project area. Anadromous fish spend most of their life cycle in the ocean and return to freshwater to spawn. Anadromous salmonids identified in Lost Man Creek include steelhead (*Oncorhynchus mykiss*), coastal cutthroat trout (*O. clarki*), coho salmon (*O. kisutch*), and Chinook salmon (*O. tshawytscha*). Most spawning and rearing occurs along the mainstem of Lost Man Creek and lower reaches of the larger tributaries.

Coastal cutthroat trout are native to northwestern California, inhabiting most coastal streams north of the Eel River. Adult anadromous cutthroat return to freshwater in late autumn and early winter and spawn in small streams between February and May. Cutthroat trout are often found in the summer in the Redwood Creek estuary. Anadromous coastal cutthroat trout occupy the project area are anadromous but this species is not currently listed or proposed, or a candidate species for listing, as threatened or endangered. RNSP fisheries staff suspect that a few resident, non-migratory populations of cutthroat trout inhabit Lost Man Creek. The project area also is inhabited by resident rainbow trout (*O. mykiss*), the non-anadromous form of steelhead trout.

Lost Man Creek contains designated critical habitat for Southern Oregon/Northern California Coast coho salmon, Coastal California Chinook salmon and Northern California steelhead. All three species are listed as threatened under the federal Endangered Species Act. Coho salmon are listed as threatened by the state of California. Reaches of streams accessible to coho and Chinook salmon in RNSP are designated critical habitat. Critical habitat consists of the water, substrate and adjacent riparian zones. Accessible reaches are those within their historical range that can still be occupied by any life stage of salmon. The three fish species and critical habitat would be adversely affected if excess sediment was delivered into Lost Man Creek.

Cultural Resources—Redwood National and State Parks contain cultural resources including archeological sites, historic structures, cultural landscapes, ethnographic properties, and objects. Some of these resources are significant and are listed or eligible for listing in the National Register of Historic Resources.

Archeological Resources: The majority of archeological sites in the parks are prehistoric. Sites are recorded throughout the parks, along the coast, inland and especially in the Bald Hills of the Redwood Creek basin. These sites range from temporary and seasonal camps to trail use sites to villages and sacred places, representing no less than a 4,500-year continuous record of habitation extending to after European contact at about 1850 by at least three different Native American groups and their ancestors. Fish, game, and acorns were particularly important foods for the local Native Americans. In addition to villages of

wooden plank houses and sweathouses, there were also numerous temporary summer camps and specialized use areas throughout the region. An extensive trade and travel network also existed. Today, the Tolowa, the Yurok, and the Hupa have ancestral ties to the parks. At the time of contact, the Yurok lived along the coast and the Chilula along Redwood Creek. The Chilula, whose territory included parklands in the Redwood Creek basin, were almost decimated after contact; most of those who remained were assimilated by the Hupa to the east of the parks.

The project area in the Lost Man Creek watershed lies within the ancestral lands of the Yurok people. Review of ethnographic literature, consultations with Native Americans, and archeological surveys indicate that pre-historic use of the heavily forested Lost Man Creek watershed was primarily limited to fishing, gathering, and hunting (Sloan 2006 and Sloan 2007). Trails passed through the area, but no settlements were reported (Sloan 2006, Sloan 2007; McConnell and Eidsness 2000).

Historic archeology in Redwood National and State Parks consists of remains of Euroamerican settlement and activities from the late 1800s. Evidence of historic settlements, ranching, logging, mining, and recreation are all types of resources that can be found. Logging was the primary historic activity that occurred in the Lost Man Creek watershed. One former logging camp dating to the 1960s is located in the proposed project area.

Ethnographic Properties: Sloan (2006) reports that important traditional Yurok plant resources are located in the project area, including alder, cascara, hazel, huckleberry, iris, maidenhair fern, redwood, salmonberry, sword fern, thimbleberry, wild ginger, and Woodwardia fern (McConnell and Eidsness 2000). Bear-grass (*Xerophyllum tenax*) is also located near the project area in the Bald Hills. This is considered the westernmost patch of bear grass as identified by Yurok and Karuk basketmakers in the 1920s (O'Neale 1995). There are no known ethnographic resources located in the area of potential effect for the proposed action listed on or eligible for listing on the National Register of Historic Places.

Consultations specific to this project conducted June 27, 2008 at the Klamath Tribal Offices resulted in the following comments (Burns and Ainis 2008). One tribal member expressed concern for resources along Holter Ridge, in particular the bear grass gathering areas. Yurok elders discussed historic trails and logging in the project vicinity, and oral history that warned Yurok people not to travel far into the Lost Man Creek area as it was considered a dangerous place. The committee felt that any bear grass patches should be protected and considered traditional cultural gathering areas. These recommendations are consistent with the consultation records from the previous projects in the Lost Man Creek watershed. There is no bear grass located within the area of potential effect for this proposed fish passage project.

Historic Resources: After the Redwood Highway was completed in 1935 through the Orick-Prairie Creek area, a temporary fish hatchery and egg collecting station were established on Prairie Creek near Lost Man Creek. These facilities were rebuilt on Lost Man Creek in 1936 as a permanent facility, the Prairie Creek Fish Hatchery. Salmon and trout were the two types of fish hatched at this facility. The hatchery was closed in 1993 and acquired by the NPS in 1996. It was listed on the National Register of Historic Places in 2000. The hatchery and its contributing elements are located outside the area of potential effect for the proposed project.

The following logging history is excerpted from Sloan 2007. The logging industry was established in Humboldt County in 1850, as a direct result of Euro American settlement and the demand for housing and manufactured goods. Logging of old growth redwood forests began in 1855 (Bearss 1969:155). Early logging efforts targeted pine, fir and spruce and later smaller diameter redwood trees, in large part due to the lack of familiarity most loggers had with redwood, particularly massive old growth redwood. By

1854 mine limber mills were operating in Humboldt Bay but several joined together to form the Humboldt Lumber and Manufacturing Company (Bearss 1969:157).

By 1860, Humboldt County was the second largest lumber producing county in California (Bearss 1969: 159). As technological improvements allowed for larger logs to be taken, area streams and rivers were utilized to float logs downstream to the coast for milling and shipping. Skid roads were created throughout the region for the purpose of hauling logs to nearby mills for processing. Early hauling methods relied on pack animals, or donkey or oxen trains to haul logs out of timber units to mills. Thin invention of the “Bull donkey” by David Evans in 1892 represented the first mechanical means for hauling logs (Bearss 1969: 189). As technology evolved over the next decades, the logging industry was able to venture further inland to obtain logs for transport to the mills and shipyards. Logging of the region reached its peak intensity following World War II and utilized heavy-duty machinery to reach old growth stands, cut, haul, and mill old growth lumber at a scale previously impossible.

Intensive logging in the Redwood Creek and Lost Man Creek areas occurred during the post WWII period, specifically between the late 1940s and 1960s (Van Kirk 1999:8). Van Kirk reports that the population of Orick went from a total of 50 (pre-WWII) to a population of 1,250 in 1948. While a single lumber mill had been in operation since the 1930s, four new mills were operating by 1947: Lumberman’s Supply on McComb’s Rand on Bald Hills, the Sunset Shingle Mill at the mouth of Prairie Creek, Harding’s Mill and Geneva Lumber Company. Geneva Lumber Company established its mill at the mouth of Little Lost Man Creek. Together with the Hill-Davis, Arcata Redwood Company, and Sage Land and Lumber Company, the Geneva Lumber Company built a series of haul roads throughout the Bald Hills and the Redwood Creek, Prairie Creek, and Lost Man Creek watersheds (Van Kirk 1999:9-10). Geneva Lumber Company sold its operation to Hammond Lumber company in 1954, which in turn sold their operation to Georgia Pacific in 1956 (Van Kirk 1999:10).

Logging in the lower region of the Lost Man Creek watershed ceased upon the creation of Redwood National Park in 1968; however, impacts of the logging are still visible. Many of the existing road systems throughout the area are remnants of old logging routes, haul and skid roads between old growth stands and nearby timber mills. Some former spur and skid roads are visible and are now utilized by visitors to the area as recreational trails. Major logging roads such as Geneva Road and Holter Ridge Road are maintained and utilized by NPS for access into parklands for management and restoration purposes. In addition to the protection and preservation of remaining old growth forest for the enjoyment of the public, NPS is continually working towards the rehabilitation and restoration of this unique ecological area.

No historic resources were identified in the area of potential effect for the proposed action that are eligible for or listed on the National Register of Historic Places.

Visitor Use and Experience—The Lost Man Creek Trail is approximately 4 miles long, extending along the former Geneva Road from the Lost Man Creek picnic area to Holter Ridge Trail which is about 6.5 miles long. Both trails are designated for hike and bicycle use. Visitor use includes the nearby picnic area and the hike or bike along the trail. The place is popular due to its location near a well marked picnic area in old growth redwood forest. The picnic area is the site of the dedication of the park as a World Heritage Site. The picnic area and the first few hundred feet of the trail are accessible.

Environmental Consequences

This section describes the anticipated affects of the alternatives on natural and cultural resources, and park operations and visitors, and is followed by a discussion of the NPS legal and policy requirements for non-impairment of park resources and values.

Methodology for Assessing Impacts—Impacts to resources were assessed using several methods, including best professional judgment and knowledge of the effects of similar actions undertaken by the NPS in RNSP and other NPS units. Impacts to vegetation, wildlife, threatened and endangered species and cultural resources were assessed through site visits and discussions among RNSP botanists, biologists and the archeologist. Impacts on threatened and endangered species were assessed in consultation with USFWS and NOAA Fisheries personnel and review of the biological opinions issued by these agencies. Impacts on water quality, hydrology and geomorphology were determined through inspection of the project area and on-site analyses by RNSP geologists.

General impact analyses on fish and aquatic habitat from removal of passage barriers and associated watershed restoration are based on the impacts described in the NOAA Fisheries' RGP 12 Biological Opinion for projects funded under CDFG Fisheries Restoration Grant Program.

Some of the short-term effects of culvert removal and channel restoration such as erosion and vegetation removal are considered to be adverse. However, these effects are unavoidable in order to remove potential threats to water quality, and riparian functions, and threatened fish species from the existing culverts and road crossing. The short-term adverse effects on the stream system can be readily mitigated through accepted best management practices such as erosion control and timing of the project. The potential long-term adverse effects from not removing failing drainage structures would be longer-lasting and more intense than the short-term effects. These long-term adverse effects are considered unacceptable, particularly in the context of the legislation establishing and expanding Redwood National Park that directs the NPS to rehabilitate areas within the park "contributing significant sedimentation because of past logging disturbances and road conditions, and to the extent feasible, to reduce the risk of damage to streamside areas..." (16 USC 79j)

Effects on Air Quality—Under the no action alternative, there would be no effects on air quality from periodic removal of debris to clear blocked culverts. Under the proposed action, there would be temporary localized decreases in air quality from emissions on heavy equipment working at the site and from dust during excavation. These effects would be adverse but negligible.

Cumulative Effects—Cumulative effects on air quality in the parks result from dust from soil disturbance and emissions from vehicles and power tools associated with maintenance of park roads and trails, second growth management, fire management including preparation of roads and firelines and smoke from prescribed fires and wildfire suppression, timber harvest on adjacent private lands, vehicle emissions from public roads and highways, and smoke from wood stoves in adjacent communities. Adverse effects from smoke from prescribed fire and wildfires would have the greatest potential for moderate adverse effects but smoke is temporary for the duration of the fire. These effects are adverse, localized to widespread, temporary but repeated, and negligible to moderate. No long-term cumulative adverse effects on air quality or air quality related values in the parks are anticipated for the foreseeable future because the regional prevailing winds are from the northwest across the Pacific Ocean where there are no sources of air pollution. The cumulative effects on air quality under either alternative would be negligible, because the primary sources of air pollution in the project area are vehicle emissions on highways and smoke from fires, and state air quality standards in the project area are rarely violated by either source.

Effects on Soils and Topography—Under the no action alternative, there would be no new changes to topography of the project area, which was previous altered by road building associated with logging. The no action alternative would not have any project related construction effects to soils in the project area, all

of which were previously disturbed by logging and road building. The road fill and soils adjacent to the stream crossing would continue to gradually erode in rain storms. The erosion rate would increase as the culverts, stream crossing and road fill degrade. Eventually, the culverts would fail completely, causing erosion of an estimated 1,050 cubic yards of road fill that would be delivered directly into North Fork Lost Man Creek.

Catastrophic failure of the stream crossing and adjacent road segment could also lead to stream bank failures as the stream channels adjust to an influx of sediment. Bank failures are a common source of slope failures in steep inner gorges such as that along a portion of North Fork Lost Man Creek upstream of the project area.

Gradual erosion at the stream crossing under the no action alternative would be a long-term adverse effect on soils adjacent to the road corridor; this adverse effect would range from negligible in years of low rainfall to moderate in wet years or intense storms. Catastrophic or eventual complete failure of the stream crossing would be a moderate to severe adverse effect on soils in the project area and could result in moderate adverse effects to local topography if slope failures result.

The proposed action would disturb about 8,000 square feet (0.2 acre) of soil to excavate the stream crossing and banks, and remove the two culverts. These soils were previously disturbed by road construction.

Under the proposed action, an estimated 2,100 cubic yards of soils would be excavated to remove the stream crossing and restore the channel form at this location. All these soils are either sediment that has aggraded in the stream channel upstream of the crossing or road fill within the crossing. The stream channel would be excavated to the depth and shape of the original channel, which is determined by locating the natural rock armor of the original stream bed and matching the steepness and shape of the adjacent streambanks to indicators such as soil horizons and the trunk swell of existing trees. The excavated road fill would be moved to a stable location where it would not erode into the stream. Newly excavated soils would be mulched with vegetation removed from the excavation site.

There would be short-term effects of the proposed action on soils and topography from the excavation of 2,100 cubic yards of material from the crossing, and stream channel and banks. The effects on soil and topography are judged to be beneficial and minor from restoration of topography in the North Fork Lost Man Creek stream channel, and beneficial and moderate for reduction of sediment threat to Lost Man Creek posed by failing culverts and road fill. The benefit to North Fork Lost Man Creek would be greater than the benefit to Lost Man Creek because the North Fork Lost Man Creek channel would be directly impacted if the stream crossing fails and because North Fork Lost Man Creek is smaller than Lost Man Creek so that a given volume of soil has a proportionately greater impact on the smaller stream.

Cumulative Effects on Soils and Topography—Under the proposed action, removal of the stream crossing in North Fork Lost Man Creek would have no direct effect on topography and soils in other sub-basins in the Redwood Creek watershed. Topography in the other sub-basins of Redwood Creek would remain altered by presence of logging roads. Soils would continue to erode in unstable areas along roads in the rest of the watershed. Landslides related to the presence of untreated roads would occasionally alter topography, particularly after major storms.

Around 1,400 miles of forest roads and over 5,000 miles of skid trails are estimated to have been built within the Redwood Creek watershed. About 445 miles of roads and 3,000 miles of skid trails were included within the national park boundaries. Replacement of about 60 feet of old logging road with a bridge under the proposed action would have negligible short-term or long-term benefits to the watershed as a whole, and minor benefits to soils and topography in the project area over the long-term. There

would be negligible benefits to the mainstem of Redwood Creek and Redwood Creek estuary and minor benefits to Prairie Creek from the proposed action. Over the very long-term, if failing roads within the park are removed and if roads upstream and outside the park are maintained and effective erosion control implemented prior to major storms, there would be a major benefit to soils and topography in the Redwood Creek watershed from preventing unnaturally high levels of erosion. The long-term benefit to the Redwood Creek estuary from reducing the influx of sediment would be a moderate benefit to estuary function because the Redwood Creek levees would continue to alter the hydrology and function of the estuary.

Effects on Water Quality, Hydrology and the Adjacent Watershed—Under the no action alternative, there would be no construction-related effects on water quality from excavation to remove the culverts or the stream crossing and install a bridge. The culverts and stream crossing would gradually degrade as these drainage structures continue to age and deteriorate. Gradual failure would release small quantities of sediment into the streams during storms. Major storms would cause more sediment to enter the streams. Eventually, the culverts and stream crossing would fail completely, which would most likely occur during a major storm. Complete failure would release an estimated 1,050 cubic yards of road fill directly into North Fork Lost Man Creek. Because the crossing is proximal to the mainstem of Lost Man Creek, failure of the crossing and stream banks would deliver sediment almost directly into Lost Man Creek. Gradual delivery of small volumes of sediment into the streams would have a long-term adverse effect on water quality from increased turbidity and sedimentation. This long-term chronic turbidity would be a minor adverse effect most noticeable after rainstorms. Complete failure of the stream crossing would have a moderate to significant adverse effect on water quality in Lost Man Creek that could persist for decades, based on effects on other park streams where stream crossings and roads have failed catastrophically.

Under the proposed action, there would be short-term adverse effects on water quality from erosion of sediment from excavation of 2,100 cubic yards of road fill to remove culverts and stream crossing to expose the natural channel elements and side banks. Erosion would be reduced by working during low flow periods in September, using silt fences and other standard best management practices for erosion control, mulching of newly exposed soils, and by completing the project prior to the onset of the rainy season. The mitigation measures to minimize degradation of water quality would reduce the short-term effects on water quality from increased sediment in the stream and higher turbidity to minor.

There would be long-term beneficial effects to water quality and hydrology from removal of failing undersized culverts and from restoring the stream channel to its original configuration. The benefit is judged to be minor to moderate, depending on the intensity and duration of rainfall events. In the event of minor flooding (10-year flood events), the benefit from removal of the stream crossing would most likely be minor. In large flood events (25-year flood events) or intense rainfall over a period of weeks, there would be moderate benefit from removal of road fill that could fail and be delivered into the creek.

The bridge that would replace the culverts on the Lost Man Creek Trail would completely span the active channel and would not constrict streamflow. The proposed action would have temporary adverse effects on water quality from erosion of newly excavated soils, primarily in the first rainy season as small quantities of sediment are flushed from the stream channel. This adverse effect on water quality would be minor for Lost Man Creek and negligible for Prairie Creek. There would be an immediate benefit to Lost Man Creek hydrology from removal of undersized stream crossings and restoration of the channel morphology. This benefit would be minor to moderate. The benefit to the hydrology of Prairie Creek would be indirect, long-term, and minor.

Cumulative Effects on Hydrology and Water Quality—The overall cumulative effects on hydrology and water quality in the park relate to past logging and road building, both within what is now the national park and upstream of current park boundaries in the Redwood Creek watershed.

The effect of stream crossing removal and associated minor watershed restoration would be a benefit to the water quality of Prairie Creek and Redwood Creek but the benefit would be negligible because of the adverse effects of remaining abandoned roads and numerous unrestored stream crossings. The removal of the stream crossing road fill on North Fork Lost Man Creek would not improve hydrological conditions or water quality in Redwood Creek upstream of its confluence with Prairie Creek.

Damage to forest resources and fish in the Redwood Creek watershed coincided with both intensive timber harvest and a series of large storms between 1955 and 1983 that were accompanied by widespread flooding and erosion. Land use activities significantly increased erosion above naturally high levels associated with storms. The large number of improperly designed and maintained roads, landings and skid trails in the Redwood Creek watershed causes increased surface erosion and fine sediment production and delivery, and an increased potential for stream diversions, rill and gully erosion, and road related landslides with corresponding increased in sediment production and delivery. Past timber harvest in what is now the park and outside the park on unstable slopes prior to the enactment of the state Forest Practice Rules and removal of riparian vegetation also contributed to increase erosion and sediment production. These factors led to the designation of Redwood Creek as a sediment impaired stream by the EPA under section 303(d) of the Clean Water Act.

Key changes in Redwood Creek mainstem channel structure over the past 40 years include increases in the volume of stored sediment; decreases in pool numbers and depth; increases in stream width and decreases in stream depth; reduced recruitment of large woody debris; deposition of high levels of fine sediment on the stream bottom; and reduced volumes of large woody debris.

NPS researchers estimate that approximately 55% of 1,400 miles of roads in the watershed are not maintained and are therefore more likely to fail during storms than maintained roads. There are several thousand crossings associated with these roads and it is likely that hundreds if not thousands of crossings continue to have diversion potential.

Long-term improvement to the mainstem of Redwood Creek from reducing sediment associated with stream crossings on North Fork Lost Man Creek would be negligible because of the small amount of sediment removed under the proposed action compared to the potential erosion volume remaining in the Redwood Creek watershed. A major storm would cause erosion in untreated, disturbed areas in Redwood Creek and the contribution of North Fork Lost Man Creek to improved conditions in Redwood Creek would be negligible in comparison to the magnitude of adverse effects basinwide.

Effects on Floodplains and Wetlands—Under the no action alternative, the floodplain of North Fork Lost Man Creek near its confluence with Lost Man Creek would continue to be altered by undersized culverts and road fill within the stream channel. When the culverts eventually fail, an estimated 1,050 cubic yards of road fill would be delivered directly into North Fork Lost Man Creek. This volume of sediment would move downstream and be delivered to Lost Man Creek, where it could fill in the channel (aggrade). This could cause floodwaters to move into the floodplain of Lost Man Creek, and cause loss of riparian wetland vegetation, primarily red alder. Delivery of sediment to the mainstem of Lost Man Creek following catastrophic failure of the stream crossing on North Fork Lost Man Creek would be a long-term adverse effect that would vary from minor to severe, depending on the intensity of the storm and the volume of the flood flows. A storm of sufficient intensity to cause catastrophic failure of roads in Lost Man Creek would cause similar effects on other tributaries of Prairie Creek, which would cause

severe damage to the Prairie Creek floodplain through scour and aggradation of the stream channel and loss of riparian vegetation.

Under the proposed action, there would be temporary adverse effects to the riparian wetlands adjacent to excavation areas from removal of about 1,500 square feet of riparian vegetation, primarily red alders and understory plants. This adverse effect would be negligible because the riparian vegetation would recover in one to two growing seasons, and all the riparian vegetation present is regrowth following the original disturbance from road construction. There would be an immediate benefit to the floodplain of North Fork Lost Man Creek at its confluence with the mainstem of Lost Man Creek and a long-term benefit to riparian wetlands along Lost Man Creek from removal of undersized drainage structures and restoration of the original stream channel. This benefit would be negligible in the short-term but minor to moderate in the long-term from prevention of future catastrophic failure of the drainage structures and road fill that could bury riparian zones and fill in the floodplain.

Cumulative Effects on Floodplains and Riparian Wetlands—Restoration within the project area would have negligible short-term adverse effects and minor long-term benefits to the floodplain of Lost Man Creek. As watershed restoration projects are completed within and outside the parks, and new logging roads upstream of the park are constructed and maintained to standards in the state Forest Practice Act, there would be a long-term moderate benefits to the floodplain of Redwood Creek. Removal of stream crossings and associated road removal would have a negligible benefit to the Redwood Creek floodplain, because Prairie Creek enter the Redwood Creek floodplain at a point where the floodplain is confined by flood control levees.

Riparian wetlands in the project area and along Redwood Creek and some of the more heavily logged tributaries, have been destroyed or degraded by the original logging and road construction, and the effects of road failures. Riparian zones along the mainstem of Prairie Creek were not as damaged as some other tributaries of Redwood Creek because the upper portion of the watershed within Prairie Creek Redwoods State Park was not logged, so that the riparian zone retained most natural functions and values. The greatest benefit to riparian wetlands outside the project area relies on the effectiveness of watershed restoration at preventing erosion that would lead to landslides that could bury riparian areas and vegetation with sediment.

Road removal and upgrades drain the small, isolated wetlands that form behind blocked culverts, filled stream channels, ditches with no outflow, and slumps in road fills. These ponds and puddles serve as breeding habitat for some amphibians, which are adversely affected by loss of this habitat. The overall effect on the forest ecosystem is negligible because the wetlands are not an original component of the ecosystem and have very limited value. The adverse effect from loss of these wetlands is negligible compared to the potential adverse effects of loss of stream functions, including riparian wetlands, in the event of road and stream crossing failures.

Effects on Vegetation—The vegetation in the project area is intact old growth forest. The only impact to the forest is associated with the former logging road where the project site is located. Under both the no action alternative and the proposed action, vegetation growing along the road would be trimmed occasionally and downed trees and limbs removed to maintain an open corridor. No other vegetation would be removed under the no action alternative. Therefore, the no action alternative would have a negligible effect on vegetation in the short-term. In the long-term, catastrophic failure of the stream crossing would cause loss of riparian vegetation along both North Fork Lost Man Creek and the mainstem of Lost Man Creek. This effect would be adverse, and minor to moderate depending on the intensity of the storm that causes the failure.

Under the proposed action, approximately 1,500 square feet of vegetation would be cut or grubbed for excavation of the stream crossing, culverts and adjacent road segment. The largest trees that would be cut would be red alders and Douglas-fir less than 18 inches in diameter at breast height. No old growth or mature conifers would be removed. The vegetation that would be removed is common in the project area. Vegetation along the road-trail corridor is routinely cut or trimmed to maintain an open corridor. Understory vegetation would re-grow within several months depending on the severity of the following winter and would be completely regrown within a few years.

Newly disturbed soils would be covered with mulch to reduce erosion. To avoid importing unwanted exotic plants, vegetation removed along the roadsides during excavation would be salvaged and placed on the excavation sites following treatment. Revegetation would occur naturally from the seed bank in the mulch and from the adjacent areas. Natural revegetation occurs quickly in the moist heavily vegetated project area.

All vehicles and equipment utilized in this project would be cleaned prior to entering park to prevent transmission of exotic species, i.e. plants or plant pathogens (especially *Phytophthora lateralis*—Port Orford cedar root disease, and *Phytophthora ramorum*—sudden oak death [SOD]). Removal of all vegetative matter or mud from the undercarriage or tracks of vehicles and equipment is sufficient for this purpose. If vehicles or equipment travel to infected areas within California or Oregon during project implementation, they must be cleaned before re-entering the park.

Under the proposed action, the primary impact to vegetation is the removal of trees that have regrown following construction of the road. Roadside understory vegetation would be removed in conjunction with the crossing excavation, but most of the disturbed area is road surface that does not support vegetation or that has been routinely cleared. Road construction and maintenance have continuously disturbed all vegetation adjacent to the road for many years.

Cumulative Effects on Vegetation—Cumulative effects on vegetation outside the project area include removal of vegetation along roads slated for removal in the Lost Man Creek Watershed Restoration Project that was initiated in 2006 and will continue through 2010 (NPS 2006a). Restoration on about 1,700 acres of second growth forests (thinning dense Douglas-fir and tan oak) in the Lost Man Creek drainage is proposed. Second growth forests along streams or in old-growth riparian zones would not be thinned. The proposed second growth management would not occur in the same areas where soils and vegetation would be disturbed by watershed restoration. Outside the watershed and forest restoration project areas, logged areas of the parks would continue to recover although the recovery in some dense second growth stands that were not thinned after replanting would require centuries to attain characteristics and functions associated with old growth forest. Fire in the project area would be managed with a full suppression strategy, which will require preparation of several ridge top roads to ensure access for fire engines and crews (NPS 2004). Fire road preparation includes brushing, culvert and ditch cleaning, and grading.

There are no Port-Orford-cedar native to the project area that would be affected by Port-Orford-cedar root disease. SOD is not known to be present in RNSP at this time but there are infections known within 50 miles of the parks.

Effects on Wildlife—Under both no action and the proposed action, there would be long-term effects on wildlife from noise and disturbance associated with routine maintenance and use of the road and trail. Typical wildlife that occupy the area such as winter wrens, varied thrushes, ravens, Steller's jays, black-tailed deer, Roosevelt elk, black bear, raccoon, and mountain lions are accustomed to the occasional presence of humans on the trail; other wildlife such as small mammals are rarely seen during daylight hours when humans are likely to using the trail. Overall visitation and trail use is light in comparison to

other areas and consists of temporary passage along the trail. The adverse effect on wildlife from use and maintenance of the road-trail would be negligible.

Under the proposed action, there would be adverse effects on sedentary wildlife that live within or immediately adjacent to the excavation sites from noise during construction and any soil or ground-dwelling organisms that live within the project site would be displaced or destroyed. The effect on wildlife species that are not tolerant of human presence and that can move out of the area would be adverse, short-term and negligible to minor depending on the species and its tolerance of humans. For those individuals that are permanently displaced from their territories or are killed by equipment, the adverse effect is long-term or permanent and major. There is sufficient habitat in the vicinity of the project area for persistence of all wildlife species and there would be no long-term adverse effect on park populations of any wildlife species. Therefore, the overall adverse effect on wildlife from project-related excavation or bridge installation would be negligible. The long-term effect on wildlife in the project area would be a negligible to minor benefit from reduction of the potential for catastrophic crossing failure.

Cumulative Effects on Wildlife—The logging that occurred in the vicinity of the project area and in other areas of the park prior to park establishment and expansion had significant adverse effects on certain terrestrial and aquatic species of wildlife. Small terrestrial species that are less mobile were directly affected by logging. More mobile wildlife species were indirectly affected by widespread loss of forest habitat and damage to streams. Aquatic species were directly affected where stream channels were blocked with Humboldt crossings (stream crossings constructed by placing logs in the channels and covering with soil instead of installing culverts or bridges) and indirectly affected by loss of shade when the forest canopy was removed and by sedimentation of streams from landslides and erosion from bare slopes. The adverse effects of sedimentation continued after forest vegetation regrew. Several species that suffered major population declines from loss of forest habitat due to logging throughout their range are listed as threatened under the federal or California endangered species acts.

Effects on Sensitive, Threatened or Endangered Species—There are no state- or federally listed plants in the project area that would be affected by either the no action alternative or the proposed action.

There would be no adverse effects on northern spotted owls and marbled murrelets because no suitable habitat or designated critical habitat for spotted owl or marbled murrelets would be affected by the proposed action. The project would have no adverse effects on northern spotted owls or marbled murrelets from noise disturbance because the project would be conducted after September 15 and completed prior to February 1. Heavy equipment work would create noise and disturbance within one-quarter mile of murrelet habitat but would occur outside the noise restriction period.

Cumulative Effects on Threatened Birds—Timber harvest is on-going on private timberlands adjacent to the parks. Spotted owls and/or marbled murrelets that nest in habitat adjacent to private timberlands would continue to be subject to increased noise disturbance from heavy equipment being operated on private lands, from helicopter logging that has occurred on private lands near the ridge top in the past few years, or from increased predation threat.

Cumulative effects on northern spotted owls would result from continued loss of suitable habitat and from increasing competition with barred owls, which are expanding their range and are considered to constitute the most imminent threat to the recovery and continued survival of northern spotted owl populations.

In 2008, the NPS reported potential incidental take in Redwood National and State Parks of marbled murrelets authorized under several USFWS BOs on approximately 2,768 acres of potentially occupied suitable habitat from noise disturbance (Bensen 2008). Approximately 0.3 acres of suitable murrelet habitat was degraded. Approximately 10,295 acres of suitable marbled murrelet habitat were subjected to

increased predation threat. Projects for which take of murrelets due to noise disturbance was reported in 2008 were annual maintenance of facilities, roads and trails, and watershed restoration in Lost Man Creek. The Lost Man Creek watershed restoration project begun in 2006 was authorized incidental take by the USFWS for expected adverse effects on marbled murrelets in occupied or potentially occupied nesting habitat due to degradation of 24 acres of suitable nesting habitat due to habitat modification; harassment on 2 acres of suitable habitat from heavy equipment operation during the breeding season; and harm from degradation of habitat due to the increased risk of corvid predation on 73 acres (NPS 2006b). For Lost Man Creek watershed restoration activities conducted in 2008, the NPS reported 0.3 acres of habitat degraded and a total of 6.1 acres affected by increased threat of corvid predation. Cumulatively between 2006 and 2008, incidental take from habitat degradation was projected to be 1.4 acres of residual old growth habitat with the actual acreage degraded of 0.7 acres. The incidental take of marbled murrelets from an increased threat of corvid predation from Lost Man Creek watershed restoration between 2006 and 2008 was projected to be 35.8 acres with an actual acreage affected of 21.1 acres.

The NPS requested, and the USFWS authorized, incidental take for increased predation threat and noise disturbance effects on 12,830 acres of murrelet habitat throughout Redwood National and State Parks caused by existing visitor and staff use of park developments and an additional 1,188 acres from construction of new trails, trailheads, and backcountry camps under the selected action in the Trail and Backcountry Management Plan for a total of 14,018 acres (NPS 2006c, NPS 2009b, USFWS 2007). In 2008, the NPS reported incidental take of marbled murrelets from noise disturbance on roads and campgrounds on 2,171 acres, and an additional 10,289 acres of suitable murrelet habitat from increased corvid predation threat due to visitor use of campgrounds, trailheads, picnic areas, and trailheads.

The NPS reported potential incidental take on approximately 2,189 acres of surveyed spotted owl habitat from noise disturbance in 2008. Other sites and projects for which incidental take of marbled murrelets was reported either do not affect northern spotted owls (helicopter use, Lost Man Creek watershed restoration under the 2001 authorization) or surveys were completed to determine that no owls would be affected in these areas. The 2006-2010 Lost Man Creek watershed restoration project was determined to have negligible to minor adverse effects on spotted owls through loss or modification of suitable habitat (NPS 2006b). The NPS requested and the USFWS authorized incidental take of northern spotted owls for operation, use, maintenance and construction of visitor facilities including campgrounds, picnic areas, trails and backcountry facilities from now through 2017 due to harassment from noise disturbance from facility operation, construction and maintenance on 2,225 acres of unsurveyed nesting and roosting habitat (NPS 2006c, NPS 2009b, USFWS 2007). Of the 2,189 acres of incidental take on surveyed spotted owl habitat reported in 2008, noise disturbance from visitor use of park facilities affected 2,059 acres.

On-going projects for which consultations with the USFWS have been completed and which have been determined that the projects may affect but are not likely to adversely affect northern spotted owls or marbled murrelets are management of exotic plants throughout RNSP, fire management throughout the parks, management of Port-Orford-cedar in the northern part of the parks, and vehicle beach access (although beach access does have adverse effects on western snowy plovers and the NPS has been authorized direct take of one plover annually.) The NPS has been authorized incidental take of up to six breeding adult western snowy plovers and their broods and 15 wintering adults annually through 2017 from harassment due to disturbance from recreational facilities on park beaches.

Projects for which consultations with the USFWS have been completed but the project has not been implemented include rehabilitation of Alder Camp Road in Del Norte County (construction initiated in June 2009), and development of visitor facilities at Freshwater Lagoon Spit. The USFWS has concurred with the NPS determination that these projects may affect but are not likely to adversely affect northern spotted owls or marbled murrelets and would not affect western snowy plovers.

Effects on Threatened Fish—Three federally listed as threatened salmonids, the Southern Oregon/Northern California Coast coho salmon (*Oncorhynchus kisutch*), California Coastal Chinook salmon (*O. tshawytscha*) and the Northern California steelhead (*O. mykiss*), occupy the project area. The proposed action has the potential to affect these listed threatened fish species and their designated critical habitat. Effects on listed salmonids and their designated critical habitat have been analyzed in NOAA Fisheries' RGP 12 Biological Opinion under section 7 of the Endangered Species Act. NOAA Fisheries determined that the location and proposed timing authorized through the RGP would not affect the California Coastal Chinook salmon. NOAA Fisheries also determined that the proposed RGP is not likely to jeopardize the continued existence of the Southern Oregon/Northern California Coast coho salmon or Northern California steelhead. NOAA Fisheries anticipates that take of listed species as a result of projects authorized under the RGP will be in the nature of temporary displacement and/or reduction in feeding rates (with a possible minimal level of mortality) and will have no long-term negative effects on the survival and recovery of listed species. Multiple fish and habitat protection measures that would be applied as conditions of the Corps' RGP would minimize the level and effect of take associated with the restoration project. Best management practices typically applied to park watershed restoration and road maintenance projects would reduce the site-specific incidental take for listed fish. Appendix B lists some of the mitigation measures typically used for park watershed restoration projects. A complete list of required mitigation measures to minimize adverse effects on listed fish species from projects funded under the CDFG Fisheries Restoration Grant Program is found in the CDFG *California Salmonid Stream Habitat Restoration Manual* (CDFG 2002).

Replacing the culverts in the North Fork Lost Man Creek crossing with a bridge would have long-term benefits to coho and Chinook salmon and steelhead trout and to designated critical habitat for coho and Chinook salmon. Coho salmon are also listed as threatened by the state of California. The existing two metal pipe culverts would be replaced with a bridge beneath which fish can pass more easily. Bridges are not prone to culvert failures in which holes worn from rusting and abrasion allow the stream to flow but up which fish cannot swim. Bridges also reduce the potential for streams to scour the streambed at the downstream end of the culvert which creates an abrupt drop between the streambed and culvert bottom.

Removing the culverts that are currently a fish barrier and providing fish access to the upper part of North Fork Lost Man Creek would increase the amount of available habitat for several endangered anadromous fish species, as well as reducing the immediate threat to the fish from erosion of sediment if the culverts fail completely.

Short-term adverse effects on listed salmonids and their habitat from instream work and increased turbidity in the first season following restoration activities would be minimized by application of mitigation measures required for projects funded through the CDFG Fisheries Restoration Grant Program. The short-term adverse effects would be negligible to minor.

The long-term effects on listed salmonids from the project to improve fish passage, restore portions of the watershed adjacent to the spawning streams, and reduce the threat of erosion would be beneficial and moderate.

Cumulative Effects on Fish—Anadromous fish stocks throughout the Pacific Northwest region are threatened by the cumulative impacts of livestock use, road construction, timber harvest, stream channelization, water diversions, hydroelectric development, overfishing, and the influence of hatchery fish on both disease resistance and genetic fitness of native stocks (USDC 1997a and 1997b).

Though few scientific data are available for accurate estimates of past salmonid populations in Redwood Creek, the limited data available indicate that the anadromous fishery of Redwood Creek has experienced

a substantial reduction during the last 30 years. Present populations of salmonid species are well below those reported in historical accounts. The earliest accounts circa 1890 reported Redwood Creek as having supported a substantial salmonid fishery (Van Kirk 1994).

Degraded stream habitat is a major contributor to the decline in numbers of salmon and trout. The combined effects of early timber harvest (i.e., removal of forest cover and construction of logging roads) and flood-producing storms have deposited large amounts of sediment in Redwood Creek and degraded habitat. Accelerated erosion caused sedimentation of the mainstem that filled deep pools, and major flood events caused significant channel adjustments including channel widening, aggradation, and bank erosion. The resultant widened streambed and shallow riffles provide little or no cover for fish. Sedimentation negatively affects egg survival and fry emergence, and fish food organisms, i.e. benthic invertebrate production. The relatively unlogged Prairie Creek drainage in Prairie Creek Redwoods State Park was negatively affected by a large influx of fine sediment in 1989 from erosion during construction of the U.S. Highway 101 Redwood Park Bypass. Other factors contributing to and exacerbating population declines are natural events including severe floods, extended drought and poor ocean conditions, overfishing, and the prolonged effects of past hatchery practices.

The Redwood Creek TMDL describes fish populations in Redwood Creek as “much reduced” compared to historic accounts. Habitat conditions are still degraded relative to pristine conditions but are showing signs of improvement. Although channel deepening and pool development have been observed in all but the lower few miles of Redwood Creek, the mainstem generally lacks an adequate pool-riffle structure and cover. Coarse sediment deposited in the mainstem allows a large proportion of the summer base flow to infiltrate and flow subsurface, thereby limiting the surface water available to fish and increasing surface water temperatures. Spawning habitat in Redwood Creek is slowly improving as gravels are cleaned of fine sediment. Tributary water temperatures are generally suitable for salmonids but suboptimal along much of the mainstem.

Other on-going and reasonably foreseeable projects for which the NPS has prepared biological assessments and completed consultations with NOAA Fisheries for potential effects to listed fish species throughout the park include annual and periodic road maintenance (NOAA Fisheries’ biological opinion and letter of concurrence 151422SWR02AR6347, March 2003); Lost Man Creek Watershed Restoration projects (151422SRW01AR54:BW, July 2003); fire management (NOAA Fisheries’ biological opinion and letter of concurrence 151422SWR04AR99149:BW, January 2005); and relocation of the RNSP maintenance facility (NOAA Fisheries’ biological opinion 151422SWR2003AR8948:BAD, October 2005). The maintenance facility project will be located outside the Redwood Creek watershed and will not have any effects on fish in the project area or in Redwood Creek but will have short-term adverse effects on juvenile coho salmon from minor habitat disturbance to replace undersized culverts with a larger arch culvert that will have long-term benefits by improving fish passage to upstream reaches of a stream.

The NPS requested incidental take for California Coastal Chinook salmon, Southern Oregon/Northern California Coasts coho salmon, and Northern California steelhead under the NPS biological assessment prepared in 2003 for the Annual and Periodic Road Maintenance Program, and the 2006 addendum. NOAA Fisheries authorized an unquantified amount of take based on miles of stream affected under a biological opinion and letter of concurrence 151422SWR02AR66347 issued in March 2003.

Future actions anticipated within the project area include road and trail maintenance downstream of the project area, fire suppression in case of wildfire but no planned fire management actions (fuel reduction, prescribed fire), and management of second growth forests on less than 400 acres outside riparian and old growth areas. Of these projects, trail and road maintenance is likely to have negligible to minor short-term adverse effects on listed fish if culverts are replaced.

Using the guidelines for project implementation outlined in the current and previous biological assessments and terms and conditions specified in associated biological opinions, cumulative adverse effects to anadromous fish or their habitat throughout the parks are expected to be minor and short-term. Long-term benefits to listed fish are expected from the reduction of threats associated with erosion and sedimentation of streams resulting from failure of untreated roads and stream crossings, and from restoration of drainage patterns and geomorphic processes.

Based on the size, nature and duration of the 2006-2010 Lost Man Creek Watershed Restoration Project and other planned watershed restoration actions in the park, the NPS has determined that the proposed projects may affect and are likely to adversely affect California Coastal Chinook salmon, Southern Oregon/Northern California Coasts coho salmon, and Northern California steelhead, their habitat, and Essential Fish Habitat (NPS 2006b). However, the short term adverse effects will be outweighed by the long-term benefits to the species and their habitats from the long-term reduction of sedimentation in park streams.

Methodology to Assess Effects on Cultural Resources

Cultural Resources are defined as archeological resources, prehistoric or historic structures, cultural landscapes, and traditional cultural properties. These resources are called "Historic Properties" when they are either listed in or are determined eligible for listing on the National Register of Historic Places under §106 of the National Historic Preservation Act (36 CFR 800, *Protection of Historic Properties*). Criteria for determining eligibility of listing such resources on the National Register include the following:

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, association, and that are associated with A) events that have made a significant contribution to the broad patterns of our history; or B) that are associated with the lives of persons significant in our past; or C) that embody the distinctive characteristics of type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or D) that have yielded, or may be likely to yield, information important in prehistory or history.

Potential impacts to historic properties either listed in or eligible to be listed in the National Register of Historic Places for this project were identified and evaluated in accordance with the Advisory Council on Historic Preservation's regulations implementing §106 of the National Historic Preservation Act (36 CFR 800, *Protection of Historic Properties*): by (1) determining the area of potential effects; (2) identifying resources present in the area of potential effects that are National Register listed or eligible; (3) applying the criteria of adverse effect to affected resources; and (4) considering ways to avoid, minimize or mitigate adverse effects.

Under the Advisory Council's regulations a determination of *no historic properties affected*, *adverse effect*, or *no adverse effect* must be made for historic properties. A determination of *no historic properties affected* means that either there are no historic properties present or there are historic properties present but the undertaking will have no effect upon them [36 CFR 800.4(d)(1)]. An *adverse effect* occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the National Register, e.g. diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the alternatives that would occur later in time, be farther removed in distance or be cumulative [36 CFR 800.5(a)(1)]. A determination of *no adverse effect* means there is an effect, but the effect would not meet the criteria of an

adverse effect, i.e. diminish the characteristics of the cultural resource that qualify it for inclusion in the National Register [36 CFR 800.5(b)].

Thus, the criteria for characterizing the severity or intensity of impacts to National Register listed or eligible archeological resources, prehistoric or historic structures, cultural landscapes, and traditional cultural properties are the §106 determinations of effect: *no historic properties affected*, *adverse effect*, or *no adverse effect*. A §106 determination of effect is included in the conclusion section for each analysis of impacts to National Register listed or eligible cultural resources.

Effects on Cultural Resources—Efforts to identify if resources eligible for or listed on the National Register of Historic Places would be adversely affected by the proposed action are documented in a report entitled A Cultural Resources Investigation of the North Fork Lost Man Creek Fish Passage Project located in Humboldt County, California, California Department of Fish and Game Project R1-100 (Burns and Ainis 2008). This document although not prepared specifically for the purposes of Section 106, does sufficiently identify if resources eligible for or listed on the National Register of Historic Places are located within the project area. A record search was conducted, field surveys were completed and consultation with the Yurok Tribe culture committee was conducted by Burns and Ainis 2008. The combined result of these efforts indicates that no historic structures, archeological resources, landscapes, or traditional cultural properties were identified in the project area.

The report recommends that there is a possibility although unlikely that archeological resources could be encountered during project implementation. The 2008 report, page 12 states:

If cultural resources, such as chipped or ground stone, historic debris, building foundations, or bone are discovered during ground-disturbance activities, work shall be stopped within 20 meters (66 feet) of the discovery, per the requirements of CEQA (January 1999 Revised Guidelines, Title 14 CCR 15064.5 (f)). The proposed is located on federal land and is considered a federal undertaking triggering the necessity to comply with Section 106 of the National Historic Preservation Act of 1966 as amended (NHPA). Inadvertent discoveries shall be treated as outlined in 43 CFR 10.4 and 36 CFR 800.13(b) (2).

The NPS concurs with this recommendation; however, the Burns and Ainis 2008 report contradicts itself in the following section entitled, *Inadvertent Discovery of Human Remains* on pages 12 and 13. This section goes on to describe the requirements of the California Public Resources Code, Section 7050.5 to be followed in the event of an inadvertent discovery of human remains. The NPS disputes this entire section of the Burns and Ainis 2008 report. Public Resources Code 7050.5 will not apply in the unlikely event that human remains are encountered during this project because the project is located on federal land. Instead, the NPS affirms that the implementing regulations 43 CFR 10 of the Native American Graves Protection and Repatriation Act would be followed in the unlikely event of an inadvertent discovery of human remains.

The NPS concurs with the rest of the findings of the Burns and Ainis 2008 document. No resources were identified in the project area that could be eligible for or listed on the National Register of Historic Places in accordance with 36 CFR 800.4; therefore, *no historic properties would be affected* by the no action or the proposed action. Under the terminology of NEPA, no long-term, short-term, or adverse impacts to cultural resources are expected from either the no action or the proposed action to improve fish passage.

In the unlikely event that previously undocumented prehistoric or historic archeological resources (e.g. flaked stone, bone, shellfish, historic bottles and cans, old wooden structures) are encountered during project implementation, work in that area will be suspended until an archeologist qualified under the Secretary of the Interior Standards has evaluated the find. Resources that should be evaluated by an archeologist could include, but are not limited to concentrations of historic bottles and cans, wood, metal or ceramic artifacts, bone, flaked stone artifacts, and shellfish. In the unlikely event that such resources are encountered, the NPS would then further consult with the SHPO and the Yurok THPO under standard 36 CFR 800 regulations.

Cumulative Effects on Cultural Resources—The proposed action would have no cumulative effect on cultural resources. Although cultural resources that may occur in the vicinity of the Lost Man Creek watershed may be important cultural resources, no known significant cultural resources are located within the project area. No future actions are expected that would have the potential for adverse impacts to cultural resources in this vicinity.

In addition, the proposed action would not change the treatment and/or management of archeological resources in Redwood National and State Parks. Cultural resources throughout the remainder of the Redwood National and State Parks would be unaffected.

Under the terminology of the implementing regulations of Section 106 of the National Historic Preservation Act (36 CR 800), no historic properties eligible for or listed on the National Register of Historic Places would be affected from either the No Action or proposed Action alternative.

Effects on Visitors and Visitor Experience—This project would provide an opportunity to educate and inform park visitors about the history of the national park, the effects of roads on park resources, and current efforts to remove and/or upgrade roads, and improve fish habitat in the park and the region.

Under the no action alternative, there would be no direct effects on visitors or the visitor experience. If the North Fork Lost Man Creek crossing fails catastrophically, visitors would be unable to use the Lost Man Creek Trail until repairs could be made. The length of time that visitors are inconvenienced would depend on when the crossing fails, but major failure during wet periods could close the road/trail for substantially longer than the estimated four weeks it would be closed under the proposed action. Under the proposed action, there would be short-term adverse effects on visitor use from the trail closure until project is complete, and long-term benefits to public safety and the quality of the experience of park visitors by providing a safe, attractive bridge with a good walking-riding surface and handrails.

Non-Impairment of Park Resources

The NPS is prohibited by law and policy from taking an action that will impair park resources or values. NPS *Management Policies 2006* (NPS 2006e) require the NPS to assess and disclose whether a proposal has the potential to impair park resources or values. This section discusses the effects on resources under the proposed action and why those effects would not impair park resources or values.

The impairment that is prohibited by the Organic Act (16 USC 1) and the General Authorities Act (16 USC 1a-1) is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. Whether an impact meets this definition depends on the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts.

An impact to any park resource or value may, but does not necessarily, constitute an impairment. An impact would be more likely to constitute impairment to the extent that it:

- affects a resource or value whose conservation is necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or
- is key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- is identified in the park's general management plan or other relevant NPS planning documents as being of significance.

An impact would be less likely to constitute an impairment if it is an unavoidable result of an action necessary to preserve or restore the integrity of park resources or values and it cannot be further mitigated.

Non-Impairment of Air Quality—Under the no action alternative, there would be negligible adverse effects on air quality or air quality related values in the park from emissions from vehicles and equipment used for maintenance of the Lost Man Creek Trail and Geneva Road. The no action alternative would not impair air quality or air quality related values in the park.

Under the proposed action, there would be short-term localized adverse effects on air quality from dust from excavation of culverts and the stream crossing, and from emissions from construction vehicles and motorized equipment. These effects would be negligible and, therefore the proposed action would not impair air quality or air quality related values of the park.

The adverse effects on air quality from dust and vehicle emissions are short-term and localized. These impacts are negligible, and therefore acceptable.

Non-Impairment of Soils and Topography—Under the no action alternative, soils would continue to erode from logged slopes and abandoned roads upstream of the North Fork Lost Man Creek crossing. The soil resources in the project area were previously disturbed through logging and road construction. Road construction altered the original topography but the alteration within the small project area does not approach the level of impairment. However, the widespread alteration of soils and topography from road construction and logging throughout the park, especially tractor logging, and the resulting road related landslides are considered an impairment. The no action alternative would not reduce the overall impairment to soils and topography throughout the park that resulted from logging and road construction prior to park establishment and expansion.

Under the proposed action, 2,100 cubic yards of soil would be excavated from the crossing and stream channel and banks. These soils are road fill or aggraded material that have washed downstream from logged slopes and abandoned logging roads. Therefore, excavation of soils under the proposed action would not impair or derogate park values but would reduce the overall impairment by a negligible amount.

The adverse effects on soils under the no action alternative that could result from failure of the culverts and associated road crossing would not be significant because these soils are previously disturbed by the original road construction. Further, failure of the culvert and associated road segment would contribute to the existing impairment of park watersheds. Therefore, these impacts on soils from culvert failure under no action would be unacceptable because soils are a critical component of watersheds whose conservation is necessary to fulfill specific purposes identified in the establishing legislation of the park, and are identified in the park's general management plan as being of significance.

The adverse effects on soils under the proposed action from removal of the culvert and associated road segment would not be significant because these soils are previously disturbed by the original road construction. These adverse effects on soils are acceptable because soils are a critical component of watersheds whose conservation is necessary to fulfill specific purposes identified in the establishing legislation of the park, and are identified in the park's general management plan as being of significance.

Water Quality, Hydrology, Floodplains, and Wetlands—Under the no action alternative, there would be continued adverse effects on water quality and hydrology of North Fork Lost Man Creek and Lost Man Creek during and following rain events large enough to cause erosion of stream banks that have been altered by previous logging, the associated roads and the earthen stream crossing. Water quality and hydrology in Lost Man Creek would be impaired in the event of a catastrophic failure of any of the stream crossing or the road, and might be impaired for many years by a road fill failure that is less than a complete catastrophic failure. These resources are currently impaired from past logging and road-related erosion although the impairment is gradually lessening as watershed restoration projects are completed and vegetation regrows on soils exposed by road construction and clearcut logging.

Under the no action alternative, there would be adverse effects to the floodplain of Lost Man Creek and the riparian wetlands associated with the North Fork Lost Man Creek stream crossing in the event of catastrophic failure. If the crossing fails catastrophically, wetlands and the floodplain would be adversely affected from deposition of sediment into the riparian zones and the floodplain would be blocked when the road fill is deposited directly into the stream channel. The capacity and orientation of the drainage system upslope of the creek would not be improved under the no action alternative. In periods of heavy rainfall, drainage from the road surface would enter the creek directly and deposit sediments washed down the road, which would increase the volume of sediment delivered into the creek.

Therefore, the no action alternative would worsen the existing impairment to water quality, hydrology, the floodplain and riparian wetlands associated with the North Fork Lost Man Creek and Lost Man Creek in the event of a catastrophic failure of a stream crossing or the associated road segment.

Under the proposed action, there would be unavoidable localized short-term adverse effects on water quality in streams and associated riparian wetlands from removal of the stream crossing, associated road segment and aggraded sediment in the stream channel. There would be a long-term benefit to water quality, hydrology, the floodplain and riparian wetlands from removal of the stream crossing, aggraded sediment and the associated road segment that alter the original drainage patterns and pose an erosional threat. Therefore, the proposed action would not cause additional impairment to water quality, hydrology, the floodplain and riparian wetlands in North Fork Lost Man Creek and Lost Man Creek and would reduce the potential for impairment to these resources related to the stream crossing and the associated road segment in the immediate vicinity of the project site on the North Fork Lost Man Creek. There would be a minor improvement to the impairment to water quality, hydrology, the floodplain and riparian wetlands in Lost Man Creek downstream of the project site.

The overall impairment to hydrology, water quality, floodplains and riparian wetlands in heavily logged areas in the Redwood Creek watershed, outside of the Prairie Creek watershed, would not be reduced by the proposed action. The overall impairment is being gradually reduced through watershed restoration projects in the Redwood Creek watershed both within and upstream of the park, and through application of regulations for the proper design, construction, and maintenance of roads associated with timber harvest outside the park.

The adverse effects on hydrology, water quality, floodplains and riparian wetlands under the no action alternative that could result from failure of the culvert and associated road segment would be locally significant and would contribute to the existing impairment of park watersheds. Therefore, these impacts

on hydrology, water quality, floodplains and riparian wetlands from culvert failure under no action would be unacceptable because the conservation of watersheds is necessary to fulfill specific purposes identified in the establishing legislation of the park, and watersheds are identified in the park's general management plan as being of significance.

The adverse effects on hydrology, water quality, floodplains and riparian wetlands under the proposed action from removal of the culvert and associated road segment would not be significant because these impacts would be minimized through application of best management practices to avoid or control soil erosion. Any construction near a perennial stream or anywhere where exposed soils could potentially erode into a stream would be implemented under the best management practices required under the NOAA BO and the California Department of Fish and Game requirements for implementation of the project under the Fisheries Restoration Grant Program. Adverse effects on water quality under the proposed action would be minimized by application of best management practices to control erosion and would be negligible. These adverse effects are acceptable because restoration of watersheds is necessary to fulfill specific purposes identified in the establishing legislation of the park, and watersheds are identified in the park's general management plan as being of significance.

Vegetation—Under the no action alternative, there would be no effects on vegetation. The vegetation is considered to be impaired by clearcut logging prior to park establishment and expansion. The no action alternative would have no effect toward reducing the impairment to any vegetation resources. The impairment to old growth redwood forest can only be reduced over centuries of regrowth.

Under the proposed action, there would be adverse effects on vegetation from removal of small numbers of small trees and understory vegetation associated with removal of the stream crossing and adjacent road segment. The vegetation has regrown following disturbance from original road construction. The vegetation is common in the park and routinely cut for annual trail and road maintenance. The alders would re-establish within five years and the understory vegetation by the next growing season. No large mature conifers would be removed. Therefore, vegetation in the project area would not be impaired under the proposed action.

There would be no new adverse effects on vegetation under the no action alternative. Effects on vegetation that could result from failure of the culvert and the associated road segment would be minor because the vegetation has been previously disturbed by clearcut logging. However, the impacts on vegetation from culvert failure under no action would be unacceptable because vegetation is a component of watersheds whose conservation is necessary to fulfill specific purposes identified in the establishing legislation of the park.

The adverse effects on vegetation under the proposed action from removal of the culvert and associated road segment would be negligible because the amount of vegetation that would be removed would be very small, the vegetation has been previously disturbed by the original road construction and logging, and vegetation would quickly recolonize the newly restored streamsides. These adverse effects are acceptable.

Terrestrial Wildlife and Aquatic Biota—Under the no action alternative, there would be no direct effects on terrestrial wildlife or aquatic biota from removal of the culvert and associated road segment. Aquatic biota would suffer indirect adverse effects in the event of catastrophic failure of any of the culvert or associated road segment. In the event of catastrophic failure, aquatic biota in the downstream reaches of North Fork Lost Man Creek and Lost Man Creek could be impaired if the stream channel is completely buried with sediment. Catastrophic failure of the North Fork Lost Man Creek stream crossing would likely be associated with widespread road and stream crossing failures throughout the park, leading

to impairment of aquatic biota over a larger area than the lower reaches of Lost Man Creek. The no action alternative has the potential for localized impairment of aquatic resources in Lost Man Creek.

Under the proposed action, soil-dwelling organisms and small sedentary non-threatened or endangered animals would be affected by removal of soils and vegetation. This is an unavoidable impact but the numbers of individual animals affected is very small in comparison to the total populations of these animals in the park. Individuals of larger, more mobile wildlife would move away from the work area during project work and would move back into the area when people and equipment are not working at non-discretionary terms and conditions from the NOAA Fisheries Biological Opinion for implementing projects funded through the California Department of Fish and Game Fisheries Restoration Grant Program and the California Department of Fish and Game manuals for implementation of projects funded through the grant program would avoid, reduce or minimize injury and mortality to aquatic biota.

Therefore, the proposed action would not impair wildlife resources, including aquatic biota in the project area.

There would be no adverse effects on terrestrial wildlife or aquatic biota under the no action alternative to the degree that no new disturbance would occur. Effects on aquatic biota that could result from failure of the culvert and the associated road segment would be moderate to significant immediately downstream, depending on the degree of failure. However, the impacts on aquatic biota from culvert failure under no action would be unacceptable because aquatic biota are a component of watersheds whose conservation is necessary to fulfill specific purposes identified in the establishing legislation of the park, and that are identified in the park's general management plan as being of significance.

Adverse effects on wildlife from removal of the culvert and associated road segment under the proposed action would be negligible and therefore are acceptable. The adverse effects on aquatic biota under the proposed action from removal of the culvert and associated road segment would be minor and localized. These adverse effects are acceptable because conservation and restoration of watersheds and aquatic resources from prevention of culvert and road failure are necessary to fulfill specific purposes identified in the establishing legislation of the park, and watersheds and aquatic resources are identified in the park's general management plan as being of significance.

Sensitive, Threatened and Endangered Species—Under the no action alternative, there would be no direct effects on sensitive, threatened or endangered plants or terrestrial animals. The no action alternative has the potential for adverse effects on listed anadromous fish and their designated critical habitat. Under the no action alternative, designated critical habitat for the fish would continue to be adversely affected by the undersized culvert that blocks free movement upstream of the culvert. If the culvert or the associated road segment fails, there could be direct adverse effects on fish should failure occur when fish are spawning or during early life stages that require clean water for successful growth and development. Any fish, redds, eggs or early life stages that are present in the stream in the event of culvert failure would be destroyed, which would be considered an impairment of the fish resources of North Fork Lost Man Creek or the mainstem below the stream crossing. Catastrophic failure of the North Fork Lost Man Creek stream crossing would likely be associated with widespread road and stream crossing failures throughout the park, leading to impairment of designated critical habitat over a larger area of the park than the lower reaches of Lost Man Creek. Depending on the timing of a storm large enough to cause catastrophic failure of the culvert, there could be direct adverse effects on fish that might be present in the stream. The no action alternative has the potential for localized impairment of listed threatened fish resources and designated critical habitat and associated impairment of listed threatened fish and designated critical habitat in other streams in the park downstream of the project area.

Under the proposed action, there would be no direct adverse impacts on adult fish during construction because the work would be accomplished when adult fish are not present. Should juvenile fish be observed in the stream when work is planned, standard best management practices outlined in the NOAA Fisheries' Biological Opinion for RGP 12 as excerpted from the CDFG *California Salmonid Stream Habitat Restoration Manual* would be used to capture and move juveniles out of the immediate work area.

Excavation of sediment from the stream channel and excavation to remove the culvert would directly affect designated critical habitat in the short-term by increasing turbidity but would have a long-term benefit to habitat from reducing the erosional threat posed by the culvert and the associated road segment, and from restoring the original configuration of the stream channel and hydrological pattern. Standard erosion control methods and best management practices would be used to minimize erosion of soils outside the stream channel and thus minimize deposition of excess sediment into Lost Man Creek after the work is completed. For the first rainy season following stream restoration, there would be adverse effects on fish from reduced water quality due to increased sediment that washes out of the newly excavated stream channel as it adjusts to its original level and configuration. The overall benefit to fish from improved passage of adult fish to upstream spawning habitat, and from reduction of the erosional threat posed by the culvert has been determined by NOAA Fisheries and CDFG to outweigh the short-term adverse effects of excavation within the stream channel. Therefore, the proposed action would not constitute impairment to the fish themselves or to designated critical habitat for listed fish species, and would reduce the level of impairment to critical habitat that has led to the listing of the fish as threatened species.

There would be no adverse effects on listed terrestrial wildlife under the no action alternative to the degree that no new disturbance would occur in the project area. Effects on listed fish that could result from failure of the culvert and the associated road segment would be moderate to significant downstream depending on the degree of failure and when the failure occurs in the spawning cycle of the fish. The impacts on listed threatened fish from culvert failure under no action would be unacceptable because the fish are an important component of watersheds whose conservation is necessary to fulfill specific purposes identified in the establishing legislation of the park, and anadromous salmonids are identified in the park's general management plan as being of significance.

Adverse effects on wildlife from removal of the culvert and associated road segment under the proposed action would be negligible and therefore are acceptable. The adverse effects on aquatic biota under the proposed action from removal of the culvert and associated road segment would be minor and localized. The overall benefit to fish from improved passage of adult fish to upstream spawning habitat, and from reduction of the erosional threat posed by the stream crossing has been determined by NOAA Fisheries and CDFG to outweigh the short-term adverse effects of excavation within and adjacent to the stream channel. Therefore, these adverse effects are acceptable. Furthermore, protection of fish habitat by prevention of culvert and road failure is necessary to fulfill specific purposes identified in the establishing legislation of the park, and anadromous fish are identified in the park's general management plan as being of significance.

Cultural Resources—There are no significant cultural resources in the project area. Cultural resources would not be affected under either the no action or the proposed action and therefore, cultural resources would not be impaired.

Scenic Resources and Opportunities for Visitor Enjoyment—There are no scenic resources in the project area that would be affected under either the no action or the proposed action and therefore, scenic resources would not be impaired.

Under the no action alternative, the Lost Man Creek hike-bike trail would not be closed for removal of the culvert and installation of a bridge. In the short-term, the no action alternative would not affect visitor enjoyment. In the event of culvert failure, the bike-hike trail would be closed temporarily until the culvert is replaced. The length of closure would depend on the availability of funding to replace the culvert. If crossing failure results from catastrophic failure in a major storm, other roads and trails are likely to be affected and the closure could potentially be a long-term situation. Closure of many roads and trails throughout the park would be an unacceptable impact to opportunities for visitor enjoyment.

Under the proposed action, the Lost Man Creek hike-bike trail would be closed temporarily for removal of the culvert and installation of a bridge for several weeks between September 16 and October 31. Fewer visitors would be affected than if the trail was closed during the primary summer season. Other hike-bike trails are available in the parks and the region. The adverse effects on opportunities for visitor enjoyment in the park from closure of the Lost Man Creek hike-bike trail would be temporary. These effects would be acceptable because temporary closure is needed to protect significant park resources and fulfill specific purposes identified in the legislation expanding the national park.

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Public Distribution of the EA

The following officials, agencies, American Indian tribes and groups, and organizations received a copy of the environmental assessment or a letter announcing its availability and its location on the Internet, along with several individuals. Copies were available at libraries and park offices. All recipients are in California.

Congressman Mike Thompson
Assemblyman Wes Chesbro
State Senator Patricia Wiggins
Chairperson, Humboldt County Board of Supervisors

Forest Supervisor, Six Rivers National Forest, Eureka
NOAA Fisheries (NMFS), Arcata
US Army Corps of Engineers, Eureka
USFWS, Arcata

Big Lagoon Rancheria, Trinidad
Hoopa Valley Tribe, Hoopa
Resighini Rancheria, Klamath
Trinidad Rancheria, Trinidad
Yurok Tribe, Klamath

California Department of Fish and Game, Eureka
California Department of Fish and Game, Redding District Office
California State Office of Historic Preservation, Sacramento
Northcoast Regional Water Quality Control Board, Santa Rosa

Backcountry Bicycles, Crescent City
Blue Ribbon Coalition, Oakley
California Trout, McKinleyville
Northcoast Environmental Center, Arcata
Northern Mountain Supply, Eureka
Orick Chamber of Commerce, Orick
Orick Community Services District, Orick
Pacific Coast Fish, Wildlife, and Wetlands Restoration Association, Arcata
Redwood Community Action Agency, Eureka
Sierra Club Redwood Chapter North Group, Arcata
Smith River Alliance, Crescent City

Del Norte County Public Library, Crescent City
Humboldt County Library, Main Branch, Eureka
Humboldt County Library, McKinleyville Branch, McKinleyville
Humboldt State University Library, Arcata

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Appendix A- Protocol for Fish Relocation and Dewatering

The following steps shall be followed in the listed order for coordinating timing of fish relocation and dewatering during stream crossing removal within the known range of anadromous salmonids and/or coastal cutthroat (USDC 2001).

a) When there is stream flow:

- i. Fish exclusion fencing shall be installed on the upstream edge of the work area, far enough from the construction area so as not to be disturbed by the construction activities.
- ii. A first attempt to capture fish stranded in the construction area upstream of the crossing shall be made using seine nets and dip nets, where possible, and, if necessary, electrofishing.
- iii. Install fish exclusion fencing downstream of the crossing, far enough downstream from the construction area so as not to be disturbed by the construction activities.
- iv. A first attempt to capture fish, stranded downstream of the construction area, shall be made using seine nets and dip nets, where possible, and, if necessary, electrofishing.
- v. After all of the fish found have been relocated, install a water diversion structure several feet downstream of the upstream exclusion fence. Divert stream flow to the downstream end of the culvert, ensuring stream flow through the lower pool while the upper pool is dewatered.
- vi. If necessary, begin dewatering the pool above the culvert. Siphon water off the top of the pool to keep the water in the pool as cool as possible and prevent sucking sediment off the bottom. The water shall be pumped out of the channel and prevented from flowing back into the channel. As the pool is lowered, fish shall continuously be removed using seine nets and dip nets when possible before electrofishing.
- vii. After all of the fish found have been removed from the upstream construction area, the diversion shall be extended to just upstream of the lower fish exclusion fence, ensuring continuous stream flow downstream of the construction area. The lower pool shall be dewatered while continuously removing the stranded fish using seine nets and dip nets when possible before electrofishing.
- viii. Another attempt shall be made to capture any stranded fish the following morning.

b) If there is standing water but no stream flow, at the time of construction:

- i. Make the first attempt to remove fish both upstream and downstream of crossing using seine nets and dip nets before electrofishing.
- ii. If necessary, begin dewatering pools above and below the crossing. Siphon water off the top of the pool to keep the water in the pool as cool as possible and to prevent stirring up sediment from the bottom. The water shall be pumped out of the channel and prevented from flowing back into the channel. As the pool is lowered, fish shall continuously be removed using seine nets and dip nets when possible before electrofishing.

c) For all dewatering, place pumps in flat areas well away from the stream channel. Secure pumps by tying off to a tree or stake in place to prevent movement by vibration. Refuel in an area outside of the active channel and place fuel absorbent mats under the pump while refueling. Pump intakes shall be covered with 2.38 mm (3/32 inch) mesh screen. Water drafting from fish-bearing streams will be conducted only within sites approved by a Park fishery biologist, and shall be done in accordance with NOAA Fisheries' *Water Drafting Specifications* (NOAA Fisheries, 2001).

d) The following procedures will be used for fish capture and relocation:

- i. Prior to capturing fish, determine the most appropriate release location. Suitable areas shall be identified based on quality of habitat, risk of predation, stranding, and water quality using the following order of preference:
 1. In the same stream, upstream of the work area
 2. In the same stream, downstream of the work area
 3. In an adjacent but similar tributary
 4. In the mainstem stream

- ii. Perform initial fish relocation efforts 3-5 days prior to the start of construction. This provides the qualified fisheries biologist an opportunity to return to the work area and perform additional electrofishing passes prior to construction. A second attempt, the morning following the initial endeavor, shall be made to capture any stranded fish.
- iii. Exclude fish from re-entering work area by blocking the stream channel above and below the work area with fine-meshed net or screens. Mesh should be no greater than 1/8". It is vital to completely secure bottom edge of the net or screen to channel bed to prevent fish from re-entering work area. Exclusion fencing should be placed in areas of low water velocity to minimize impingement of fish. Screens should be checked periodically and cleaned of debris to permit free flow of water.
- iv. Periodically measure air and stream temperatures. Cease activities when water temperatures exceed 68 degrees Fahrenheit.
- v. Minimize handling of salmonids. When handling is necessary, always wet hands or nets prior to touching fish. Periodically measure air and stream temperatures. Cease activities when water temperatures exceed 68 degrees Fahrenheit.
- vi. Place captured fish in cool, shaded, aerated, dark colored container filled with cool, clear water. Provide aeration with a battery powered external bubbler. Protect fish from jostling and noise and do not remove fish from this container until time of release. Release fish when the container reaches capacity or within one and a half hours after capture.
- vii. Place a thermometer in the holding container, and periodically conduct partial water exchanges, if water temperature gets too warm or there is more than an hour of delay between when the holding container was brought to maximum capacity and the time of release.
- viii. Avoid overcrowding in containers. Have at least two containers and segregate young of the year fish from larger age classes to avoid predation. Densities shall not exceed 5 fish per gallon of water in each container. If found, place large amphibians, such as Pacific Giant salamanders, in the container with the larger fish.
- ix. Cease capture, and release listed salmonids when containers are filled to capacity.
- x. Visually identify species and estimate year classes of listed salmonids at time of release. Do not anesthetize or measure listed salmonids.
- xi. If mortality during relocation exceeds 5% of fish captured, stop efforts and immediately contact NOAA Fisheries.

Appendix B—Best Management Practices to Minimize Project Effects on Fish

The following best management practices (BMPs) were developed for the Lost Man Creek watershed restoration project which began in 2006 and is expected to continue through 2010 (NPS 2006a, NPS 2006d.) These BMPs are implemented for all NPS projects that have the potential to affect listed salmonid species or their habitat within the park.

Riparian cover on fish-bearing streams and where non-fish bearing streams lead immediately into fish-bearing waters will be protected wherever reasonably feasible, balancing quality and benefits of the riparian cover against risks of sediment delivery.

Effective erosion control measures shall be in place at all times during restoration activities. Activities within the 5-year floodplain of fish-bearing streams will not begin until all temporary erosion controls (e.g., straw bales, silt fences that are effectively keyed in) are in place, downslope of project activities within the riparian area. Erosion control structures shall be maintained throughout, and possibly after, activities. Erosion control devices such as check dams, silt fences, and other acceptable techniques shall be used when the potential exists to have sediment or other materials entering bodies of water.

- Any disturbed ground must receive appropriate erosion control treatment prior to the beginning of the wet season.
- All non-emergency project work will be completed during the normal operating season (NOS), that is, between June 15 and October 15 of each year. If more than 0.5 inches of rain is forecast during the dry season, project operations will temporarily cease and sites will be winterized. If periods of dry weather are predicted outside of the NOS, additional small work items may be done, if they can be completed within the window of predicted dry weather. Only those repairs needed to reduce risks from active erosion will be undertaken outside of the NOS, in coordination with NOAA Fisheries.
- Work sites will be winterized at the end of each day when significant rains are forecast that may cause unfinished excavations to erode. Winterization procedures are supervised at all times by RNSP geologists and involve taking measures necessary to minimize erosion on unfinished work surfaces. Winterization includes the following: smoothing unfinished surfaces to allow water to freely drain across them without concentrating or ponding; compacting unfinished surfaces where concentrated runoff may flow with an excavator bucket or similar to minimize surface erosion and the formation of rills; and installation of culverts, silt fences and other erosion control devices where necessary to convey concentrated water across unfinished surfaces, and trap eroded sediment before it leaves the work site. Adequate erosion control supplies (gravel, straw bales, shovels, etc.) shall be kept at all restoration sites to ensure excavated material is kept out of water bodies.
- Equipment, both hand tools and heavy equipment, will be inspected daily to check for leaks. Equipment that may leak lubricants or fuels into drainage will not be used until leaks are repaired. All equipment will be stored, serviced and fueled outside of riparian areas and away from stream crossings. Heavy equipment will be cleaned (e.g., power washed, steam cleaned) prior to use below the ordinary high water mark.
- A spill plan and materials for spill containment will be available to onsite personnel and all personnel shall know how to use them. In the event of a spill, work shall be stopped immediately, clean up shall begin and the appropriate authorities will be notified.
- Petroleum products, chemicals, fresh cement, deleterious materials, or water contaminated by the aforementioned shall not be allowed to enter flowing waters.
- Disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flows, shall be minimized during excavation.

- Streams with significant surface flow capable of sediment transport off-site must be diverted around excavation areas. The diverted flows shall be returned to their natural stream course as soon as restoration is complete and prior to the rainy season. Any turbid wastewater from project activities and de-watering is disposed of off-site in a location that will not drain directly into a stream channel or carry sediment-laden water into a stream channel.